REPORT OF THE
NATIONAL COMMISSION ON AGRICULTURE

1976

PART IV
CLIMATE AND AGRICULTURE

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GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE AND IRRIGATION
NEW DELHI

PREFACE

The Report of the National Commission on Agriculture comprises 69 chapters in 15 parts. A complete list of chapters and parts is given in pages (ii) and (iii). The Terms of Reference of the Commission and its composition are given in Part I - Chapter I - Introduction.

This volume entitled 'Climate and Agriculture', is Part IV of the Report and is divided into the following two chapters:

13. Climate and Agriculture
14. Rainfall and Cropping Patterns

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Entries in each taluk are shown thus -

(1) $\dfrac{M}{R_f / R_d}$ (II) $\dfrac{b_{m\,n}}{R_f / R_d}$

(Paragraph 14.4.6)

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CLIMATE AND AGRICULTURE

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13

CLIMATE AND AGRICULTURE

1 INTRODUCTION

13.1.1 "It is intolerable that this world of the 1970's with all its scientific progress and its slowly growing sense of common purpose, should go on enduring a situation in which the chances of enough decent food for millions of human beings may simply depend on the whims of one year's weather". The Director General of the Food and Agriculture Organisation (FAO) of the United Nations said this in a statement to the Press on February 1, 1973. The statement very aptly sums up the Indian scene and the recurrent years of low food production during the past decade are still fresh in our memory. In a predominantly agricultural country like India, national progress is vitally linked with increasing production of agricultural crops. A major factor influencing growth, sustenance and yield of crops is weather, in fact, weather is significant in nearly every phase of agricultural activity from the preparatory tillage to harvesting and storage. Successful farming, therefore, calls for appropriate decisions in relation to weather for choice of crop, sowing, transplanting, scheduling of irrigation, fertiliser application, use of pesticides etc. A knowledge of risk due to adverse weather conditions such as drought, floods, hailstorm, frost and environmental conditions conducive to pests and disease incidence is essential.

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13.1.2 The Royal Commission on Agriculture (RCA) (1928) recognising the close relationship of weather and agriculture recommended that:

> "Much useful light would be thrown on agricultural questions if the weather data collected by the Meteorological Department were correlated with the statistics of area sown and yield of crops collected by the Revenue Departments. Agricultural Departments should make themselves responsible for meteorological studies relating to the influence of weather conditions on the growing crop".

In pursuance of the above recommendation, the India Meteorological Department (IMD) commenced work on agricultural meteorology in 1932 and has been conducting micro-meteorological studies in cooperation with agricultural institutes and State Agriculture Departments. In 1945, a coordinated Crop-Weather Scheme, patterned on the model of the British Crop Weather Scheme, was introduced. The scheme aimed at collection of basic meteorological and crop data in a farm environment with a view to studying their inter-relationships, with an attempt to study the effect of individual climatic elements like temperature and rainfall on crop yield as a necessary first step. Standard statistical techniques were employed, but the results obtained could not lead to a fuller understanding of the complex biological processes of the plant, which are conditioned by a large number of combinations of the environmental factors. A broadening of the scope of investigation is found necessary to encompass wider considerations like energy budget and water balance.

13.1.3 Several aspects of this subject need detailed study.

In a paper[1] presented at the symposium on crop, weather and water relationship in agricultural production, a few specific problems were raised on the role or contribution of each of the factors of weather and technology to crop production. In this connection, reference was made to the large decline in production in 1965-66 and 1966-67 as compared to 1964-65 and the much larger rise in 1967-68, a normal year, and almost stationary production in spite of unfavourable weather conditions over large parts of the country in 1968-69. These raise the important question on the relative roles of weather and technology. Similarly for the planner, it would be helpful to know in advance, the years' production well before the date of harvest, but the question is whether this could be attempted through the use of meteorological factors. A related point is whether Indian climate has trends, periodicity, points of symmetry etc. which could be used for purpose of prediction. Another point concerns weather in relation to pests and diseases. The major problem of crop-weather relationship, however, persists. An attempt has been made to analyse these and other related problems in the subsequent sections.

---

[1] Sarma J.S., 1969. Crop-weather relationship - Areas of Study. Symposium on Crop, weather and water relationship in agricultural production - Annual Conference, Indian Society of Agricultural Statistics, Bombay.

2 CLIMATE

13.2.1 A brief introductory account is given of the main climatic features of the country and this is followed by a discussion of climatic factors important to agriculture, such as precipitation, rainfall variability, rainfall correlations, breaks in rainfall, temperatures, wind, sunshine and radiation and climatic change - trends and periodicity.

General Description

13.2.2 The climates of India are varied and diverse. Khasi-Jaintia Hills (Meghalaya) in the extreme east is one of the rainiest areas in the world with annual averages of the order of 1000-1050 cm while in the extreme west in Rajasthan there are areas receiving less than 10 cm. The contrasts in climate are striking. Punjab and adjoining areas have continental climates with extremes of temperature ranging from 45-50°C in summer to near freezing temperatures in winter, while Kerala has equable maritime climate throughout the year. The major feature of Indian climate is the alternation of the seasons when the winds reverse in direction twice in the year. The seasonal features are:

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i) In the winter months of December to February, the principal feature of weather is the passage of western disturbances over the northern areas of the country which receives significant precipitation. Kashmir gets rainfall of 10 cm per month or more during January and February. The precipitation in the adjoining plains is small, 3 cm pm or less and very uncertain too. Because, however, of its importance for crops a seasonal forecast of total rainfall and snowfall combined (in north-west India) for January to March is issued by the IMD. The extreme southeast of the peninsula gets significant rainfall during November and December. In the rear of the areas affected by western disturbances in the north strong cold winds blow and temperatures fall considerably giving rise occasionally to cold waves. The fall in temperatures may be 10 to 12°C below normal and near frost or frost conditions are not uncommon.

ii) March to May is a period of continuous rise in temperatures over most of the areas of the country. In March, temperatures are highest in the Peninsula with order of 38°C and the seat of maximum shifts to north and northwest by May with temperatures of 45 to 50°C. This is a period of severe thunderstorm activity all over the country and where moisture is less as in the north and northwest duststorms are more frequent. Maximum wind speeds in thunderstorms have exceeded 100 knots but 60 to 80 knots are more common. Rainfall is substantial in Assam and neighbouring areas and in Kerala and adjoining Karnataka and Tamil Nadu. In fact May is an important rainy month in areas to the south of Bangalore. Thunderstorms are also sometimes accompanied by hail. Hailstorms are more common in the north and northeastern areas and some of them are of destructive violence, the stones varying up to 7 to 8 cm in diameter.

iii) June to September is the rainiest period of the year for most of the country. The southwest monsoon sets in on Kerala coast towards the end of May, the average date being May, 30 and proceeds northwards. The monsoon is established all over the country by the end of June. The orography of India considerably modifies the flow patterns in this season. The principal feature of this season is the trough of low pressure on the sea-level pressure max. This extends from the Punjab in the northwest to the head of the Bay of Bengal. Depressions form in the north Bay of Bengal and move in a westerly direction across the country giving heavy to very heavy rainfall. The intensity and degree of monsoon rainfall vary from year to year. The monsoon may set in late with large delays in rainfall, have long breaks in July and August or withdraw earlier. It is essential to note these variations in distribution and plan agricultural operations accordingly. The daily variations of the monsoon trough position and the associated rainfall. The daily frequency of the locations[1] of the trough during July and

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[1] Forecasting Manual. India Meteorological Department, Poona.

August of the years 1961 to 1969 corresponding to longitudes 77°E, 81°E and 87°E is shown below. The position was considered normal, if the trough was located between latitudes 27° to 29°N along 77°E, 25° to 27°N along 81°E and 23° to 25°N along 87°E.

Monsoon Trough – Percentage Frequency of Locations.

	longitude	77°E	81°E	87°E
	S*	27	27	37
July	M*	30	48	35
	N*	43	28	28
	S	20	24	3
August	M	33	47	39
	N	47	33	27

*S south N north of normal position(M).

Over NW India trough is represented by longitude 77°E. The trough is north of normal position on about 45 per cent of days during July and August. This large frequency of northerly positions may be due to the influence of mid-latitude systems moving across north of India. Southerly positions are mainly associated with the passage of monsoon lows or depressions from the Bay of Bengal or with those forming over northeast Arabian sea and Gujarat. This frequency is, however, small. The trough is in normal position on about half the days along 81°E. Slightly increased frequency in northerly positions in August is mainly due to more northerly tracks of Bay depressions in this month. In northeast India and north Bay of Bengal (along 87°E), the frequency during July and August is nearly the same for corresponding positions. On 70 per cent of the days, the monsoon trough is either normal or to the south of it. The 12 GMT position of the trough on any day and the rainfall reported at 03 GMT next day at stations within two degrees of latitude on either side of the line along longitudes 77°, 81° and 87°E were examined. The frequency of occurrence of different intensities of rainfall is shown below:–

Percentage Frequency of Rainfall

	longitude °E	no rain	light (less than 7.5 mm)	moderate (7.5–35.5 mm)	heavy (greater than 35.5 mm)
July	77	19	39	27	15
	81	13	47	26	14
	87	8	55	29	8
August	77	15	40	26	19
	81	13	42	25	20
	87	11	52	24	13

About 35 to 45 per cent of the days received moderate to heavy rainfall along the longitudes considered.

iv) In addition to the trough, note has also to be taken of the depressions/storms* forming in the head of the Bay of Bengal in this monsoon season and moving in a westnorthwesterly or northwesterly direction. The average frequency for June to September is about 7. The average latitudinal positions of depressions crossing different longitudes from 92° to 75°E together with their respective standard deviations are given in Appendix 13.1 - Statement I. From long. 75° to 90°E, the standard deviation varies between 1.3 to 1.5° and standard deviation of the mean is about 0.1° only over many longitudes. This is a clear indication of the high stability of the mean track positions. It may be seen from statement I, Appendix 13.1 that the rise in average latitudinal position is 0.2° for one degree of longitude from 91° to 88°E and thereafter from 87° to 78°E generally between 0.3 to 0.4°. As heavy to very heavy rain is associated with passage of depressions and the maximum is in the southwestern sector, the mean track is helpful for prediction of direction of movement mainly on climatological considerations.

v) October-November is a transition period. Weather is generally fine except in the south peninsula which gets significant rainfall in these months. The averages can be even 30 cm in small parts of Tamil Nadu coast. October and November together account for 40 per cent of annual rainfall in Tamil Nadu and neighbouring areas. The important feature of this season is the storms* (sometimes severe or very severe) forming in the Bay of Bengal which strike the east coast of India and recurving northeast causing heavy damage to life and property. In October storms originate between latitudes 8 to 14°N and move initially in a northwesterly direction and a number of them recurve and move northeast. The average number of storms depressions based on 80 year records is four during October to December and of these only two cross coast. The following short table[1] shows the frequency of storms/depressions crossing or coming within a degree of the east coast of India for various latitudinal positions.

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* The minimum wind speed in a cyclonic storm is 34 knots and in depressions 33 knots or less.

[1] Srinivasan V. and K. Ramamurthy, 1971. Weather over the Indian Seas during the Post-monsoon season, Forecasting Manual, Part III-4.1, India Meteorological Department, Poona.

Frequency of Storms/Depressions crossing Coast
(1891-1970)

latitude °N/	October	November	December
22 - 21	5	2	-
21 - 20	7	2	-
20 - 19	11	3	-
19 - 18	8	5	
18 - 17	5	2	-
17 - 16	16	3	2
16 - 15	7	4	1
15 - 14	8	4	-
14 - 13	4	5	2
13 - 12	5	12	1
12 - 11	3	8	3
11 - 10	1	11	2
10 - 9	-	1	3
9 - 8	-	2	-
total	80	64	14

The most frequent positions where east coast has been struck in October is between latitudes 14 to 17°N and 18 to 21°N. In November lowest latitudes 10-13°N predominate and account for 50 per cent of total. Very heavy rains of 20 to 40 cm in 24 hours are not infrequent though occasionally even 50 cm has been reported. If one examines the frequency of daily rainfall, it will be noticed that it is a few heavy falls which account significantly in the annual totals and the absence of the storms in any year would mean reduced rainfall. Besides the heavy rainfall it is also the very strong winds reaching speeds of 100 to 120 knots which cause extensive damage to property. The maximum estimated winds in gusts during severe storms is of the order of 150 knots and strong winds have been experienced in different parts of the east coast right up to West Bengal and Bangladesh.

Rainfall

13.2.3 The Rainfall Atlas of India[1] contains maps of normal monthly, seasonal and annual rainfall and rainy days and of variability of rainfall (coefficient of variation CV). The Atlas includes also maps of seasonal rainfall as per cent of annual. The Introduction to the Atlas gives a short account of the main features of rainfall of the country. In view of this, no detailed account of rainfall will be given here except for a brief reference to the annual features. Almost the entire country east of longitude 79°E (Tiruchi - Jabalpur - Bareilley) and the West coast has normal annual rainfall of more than 100 cm; in particular Assam and neighbouring areas and most of the west coast gets more than 250 cm. Rainfall in the Peninsula excluding coastal belts is generally 50 to 75 cm and in northwest India it decreases to less than 30 cm west of Jodhpur. More than 80 per cent of the annual rainfall is received during June to September excepting in the Peninsula south of Hyderabad to the leeside of the Ghats, south of Cannanore (Lat. 11°N) along the west coast, in Assam and adjoining areas, West Bengal and coastal Orissa and in the northern areas of Jammu & Kashmir. In these eastern States the percentage is 70 to 80; the reason for the lower percentage is the significant rainfall of May and October in these areas. Appendix 13.2 - Maps I to III show rainfall of July, June to September and annual. Map VI (a) shows June to September seasonal rainfall as percentage of annual. Data showing subdivisional rainfall and rainy days and coefficient of variation are given in Appendix 13.1 - Statements II to IV. What is of primary concern for agriculture, however, is the distribution of rainfall during periods of crop growth. This aspect is examined in detail in Chapter 14 on Rainfall and Cropping Patterns. The volumes on rainfall and cropping patterns of the various States which are published separately also include detailed rainfall analysis pertaining to their respective areas.

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[1] 1971. Poona, Rainfall Atlas of India, India Meteorological Department.

Rainfall Normals

13.2.4 The rainfall normals at present in use are those published by the IMD[1] which are based on available data during 1901 to 1950 with a minimum of five years. The total number of stations in this publication including closed stations is 2693. The distribution Statewise along with the number at present is shown in Appendix 13.1 - Statement V. These normals are more than two decades old and there is frequent demand for more recent normals and that these should cover all the raingauge stations, as far as practicable. Another point concerns the normals for shorter periods; if these could be reduced to normals for a uniform period, their usefulness in comparison would be more reliable. The publication also contains normals of districts. As the number of stations have not remained uniform, district normals for different periods are not easily comparable. Besides there are districts with wide range in annual rainfall. The district averages, in such cases are likely to be misinterpreted. A review of the method of working out normals for short periods, districts etc. seems necessary. A connected but important question is the preparation of subdivisional departures monthly, seasonal and annual. The number of raingauges in each of meteorological subdivisions has not remained constant and various normals have been used in working out departures. It is necessary that IMD reviews the entire question of preparation of normals of rainfall and number of rainy days and publishes very early the latest set of normals for use and reference.

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[1] 1962. Monthly and Annual normals of rainfall and number of rainy days (based on records from 1901 to 1950). Memoirs, India Meteorological Department, XXXI (III), New Delhi.

Dates of Onset and Withdrawal of Southwest Monsoon

13.2.5 The main rainy period is the southwest monsoon which is also the kharif season for crops. It would be of help to agriculturists to have a broad idea of the normal rainy periods in the different parts of the country. For this purpose, Appendix 13.2 - Map VII shows the normal dates of onset and withdrawal of the southwest monsoon. These have been prepared initially from graphs of five-day normals of rainfall for about 200 stations. The middle day of the characteristic rise in rainfall, mostly in June was plotted for each station and the isopleths drawn. Similarly from the characteristic decrease in rainfall, the dates of withdrawal were worked out and corresponding map prepared.

13.2.6 In this connection it is necessary to emphasise that the amounts of rainfall corresponding to the dates of onset of monsoon, may not in many parts of the country meet the minimum rainfall requirements for the sowing of crops. A clear understanding of the distinction between the two is necessary. The maps provide the normal date of start of the rainy season and the duration of the season; as a first indication this would be of value for initial planning. Some studies on the amounts of rainfall needed for sowing and their dates of occurrence have recently been initiated in the IMD but would need to be tried out in practice before stabilising the approach. To give an idea of the range of variation in the normal dates of onset and withdrawal of the southwest monsoon, we consider here Kerala and Bombay for which data of seventy years 1901-70 are available. The frequency distribution of dates is shown in Table 13.1.

Table 13.1

Frequency Distribution of Dates of Onset of Southwest Monsoon over Kerala and Bombay - 1901-70.

dates		number of years	
		Kerala	Bombay
May	11-15	5	
	15-20	8	
	21-25	7	1
	26-31	12	3
June	1- 5	20	12
	6-10	14	22
	11-15	3	25
	16-20	-	4
	21-25	1	3
mean date		May 30	June 9
median date		June 1	June 9
range		May 11 to June 25	May 20 to June 25
standard deviation (days)		9	6

The range of variation in dates of onset in Kerala extends over six weeks while in Bombay it is less, five weeks. The important point is the high variability of the dates of onset and the position would not be different even for the dates with specified amounts of rainfall needed for sowing. A few decades ago an attempt was made to forecast the dates of onset of monsoon and in view of the importance of such studies for agriculture, it is desirable to study dates for sowing in the different parts of the country with a view to their forecasting when such dates are found helpful after trial by agriculturists in actual practice.

Frequency of Daily Rainfall

13.2.7 To give an idea of the occurrence of different intensities of daily rainfall, frequency tables are available for about 300 stations in the different parts of the country.

These tables serve the purpose of indicating frequency of heavy rain in different parts of the country and also their approximate contribution to the annual total. In fact, in many areas of the country it is only a few heavy falls which account for most of the annual rainfall. As an example, in Saurashtra and Kutch only 10 per cent of the total number of rainy days account for about 50 per cent of the total annual rainfall. As such information is of value to agriculture, it is desirable that IMD should publish for all the taluk stations (and representative stations in States which do not have taluk or tehsil divisions of districts) frequency distribution of daily rainfall using a uniform period 1901 to 1960.

Nature of Frequency Distribution of Rainfall

13.2.8 Information on the nature of frequency distribution of rainfall is of importance for evaluating probability of occurrence of different daily rainfall amounts. It is found that frequency distributions of daily, weekly and monthly rainfall do not follow the normal or Gaussian distribution. In fitting these distributions incomplete Gamma type distribution is employed and probabilities are evaluated accordingly. The use of probability values of weekly rainfall is often limited because of the extremely high variability of such weekly values. However, these weekly data may be of use for various agricultural purposes. It is desirable that IMD publish weekly totals of rainfall for all the stations for which at least 20 years' data are available in consultation with Indian Council of Agricultural Research (ICAR) and other user interests. When we

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examine[1] the frequency distributions of seasonal (June to September) and annual rainfall, these are found to mostly follow the normal law. This result is useful for quickly evaluating seasonal and annual probabilities and in other statistical analysis.

Depressions/Storms and Heavy Rainfall

13.2.9 Depressions and Storms forming in the Indian seas and travelling over land cause very heavy rain. 40 cm or more in 24 hours is not infrequent particularly in Andhra and Tamil Nadu coastal areas. More than 25 cm in 24 hours has fallen all over the country excepting in certain interior parts of the Peninsula and the extreme northern areas. The IMD has brought out atlases[2] showing the tracks of all the depressions and storms during 1891 to 1960 and 1961 to 1970. Auxiliary maps showing the frequency of depressions passing over different land areas and areas of formation are also included. Very heavy and heavy rain is invariably associated with the passage of storms and depressions and in many areas contributes significantly to the total annual rainfall as mentioned earlier. A knowledge of their frequency or probability of occurrence in different areas should be of help in planning.

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[1] Rao K.N., George C.J., Abhyankar V.P., 1972. Nature of the frequency distribution of Indian rainfall: Monsoon and annual. Indian Journal of Meteorology_and Geophysics, 23 (4): 507-514.

[2] 1968. Tracks of Storms and Depressions in the Bay of Bengal and Arabian Sea, 1877-1960. India Meteorological Department.
1972. Tracks of Storms and Depressions in the Bay of Bengal and Arabian Sea, 1961-1970. India Meteorological Department.

Snowfall

13.2.10 The India Meteorological Department prepares every year an annual summary of snowfall information collected from its few observatories and the reports of Government officials and travellers in the areas to the north and northwest of India. The reports are mostly qualitative except those based on the reports of observatories. Though considerable improvement and expansion of network of observatories has taken place in recent decades, the position still needs careful review. The problem of obtaining quantitative snowfall information from mostly inaccessible regions is difficult. The importance of snowfall was recognised by Blanford (Chief Meteorological Reporter) as early as 1880. He had observed that heavy snowfall in the region to the north and west of India caused abnormal pressure conditions and was unfavourable to the advance of the monsoon over the areas affected. Later, snow accumulation at the end of May came to be included as one of the significant factors in the regression equation used for forecasting monsoon rainfall. In recent decades, however, the earlier degree of association (correlation coefficient) has not been maintained and has even changed sign. This may be due to the nature of the approximations involved in putting the snowfall information in quantitative figures. Another direction in which snowfall information was used was to find out its contribution to river flows. The analysis was done about two decades ago and the data available did not show encouraging results. All these only show the urgent need for recording and collecting snowfall data in a systematised form for further analysis and use. We recommend intensified efforts by IMD to organise a good snowfall network to enable a fuller understanding of its role on subsequent weather and its contribution to river flow.

Glaciation

13.2.11 A related subject is the study of glaciers. Except for a few isolated expeditions in the Himalayas, work in this field is almost absent. We are hardly aware of its potential in the context of water resources of the country. It is understood that the Geological, Meteorological and other connected departments or organisations are planning coordinated programmes of glacier studies, but it is necessary that systematic work should be organised and for the purpose suitable organisation needs to be developed in the Meteorological and Geological Departments which are closely connected with the subject.

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Dew

13.2.12 Dew is water vapour in the atmosphere condensed on surfaces of objects exposed to nocturnal radiation. This could be an additional source of moisture for plants. Observations of dew were started on a regular basis from 1968 with a network which now consists of about 80 stations. A preliminary analysis[1] using data of two to three years has shown the following features.

i) Dew accumulation is 15 to 30 mm in north and northeast India during October to March. This deposition is comparable to values in other tropical and even temperate countries. The largest value is over Assam with a six month accumulation exceeding the annual amount in Israel.

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[1] Raman, C.R.V., Venkataraman, S and Krishnamurthy, V., 1971. Dew over India and its Contribution to winter Crop-Water Balance - Prepublished Scientific Report No. 147, India Meteorological Department.

ii) The total dew in January in the submontane plains of north India from south Punjab to Assam where water stress in this month is about 40 mm, could meet about 25 to 50 per cent of water deficiency. In the dry area dew deposition is too small to contribute soil moisture.

The picture does not yet seem promising for the relatively drier areas.

Rainfall Variability

13.2.13 Indian rainfall is highly variable. Two places may have the same or nearly the same averages but with differing degrees of variability. Therefore, the publication of averages without a measure of their standard errors is likely to lead to differing interpretations. As a rule, we recommend that rainfall averages should be always accompanied by their respective standard deviations. The measure used for describing variability is the coefficient of variation (CV). Because of its importance, the variability in different parts of the country is briefly stated.

i) January-February: CV is 80 to 100 per cent or higher except in Kashmir and northeast Assam where it is 40 to 50 per cent. Rainfall in these months is very highly variable and uncertain.

ii) March-May: CV for this season is 30-40 per cent in Assam and neighbourhood, 40-50 per cent in West Bengal, South Kerala and interior areas south of Bangalore excluding east coast. Elsewhere CV rises rapidly to 80-100 per cent or higher.

iii) June-September: June CV is 30-40 per cent along West Coast and northeast Assam and 60 to 100 per cent elsewhere. Almost the entire area west of Bombay-Lucknow and south of latitude 16°N, CV is 80 to 100 per cent or higher. In July which is generally the rainiest month for most of the country, CV is 40 per cent or less east of longitude 80°E (Madras-Jabalpur-Bareilley) and along the West coast. CV is high over northwest India increasing from 50 per cent to 80 to 100 per cent west of Jodhpur. In the peninsula on the leeside of the Ghats covering Madhya Maharashtra, Karnataka, Rayalaseema and Tamil Nadu CV is mostly 80 to 100 per cent. August CV distribution is nearly similar to July. September CV showing marked difference from earlier months, CV in the peninsula including coast is generally 60 per cent with pockets of 80 to 100 per cent in the southeast. The season's CV is 20 to 30 per cent east of longitude 80°E and along West coast. In the Peninsula it is 40 per cent rising in the extreme southeast to 80 to 100 per cent. West of Lucknow, up to Jodhpur, CV is 30 to 50 per cent and higher elsewhere.

iv) October to December: October CV is 80 to 100 per cent except for southern portions of the peninsula and Assam where it is of the order of 60 per cent. November CV is 60-80 per cent in Tamil Nadu and Kerala and 80 to 100 per cent or higher elsewhere. December is 80 to 100 per cent in the southeast Tamil Nadu and more than 100 per cent in the rest of the country.

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v) Annual: West of Surat to Delhi line, CV exceeds 30 per cent and rises rapidly to 60 to 80 per cent in west Rajasthan and Kutch. Elsewhere CV is 20 to 30 per cent with lower values along west coast and in northeast Assam.

As may be seen from the above, great caution is necessary in interpreting the behaviour of rainfall in India. Monthly rainfall variability even in the rainiest months (July and August) and areas, is as high as 40 to 50 per cent. When one comes to September, CV is higher and in October uncertainty becomes nearly complete. If these aspects are not taken note of in crop planning, risk of uncertainty with consequent failure is great. In the case of winter months the amounts are small and CV very high. We recommend that when the next set of normals are worked out, simultaneously CV also should be computed and both published together. Maps showing Coefficient of Variation for July, June to September and Annual are included in Appendix 13.2 - Maps IV to VI. These have been taken from the Rainfall Atlas of India (1971), published by the India Meteorological Department.

Rainfall Correlations

13.2.14 There are frequent queries on the relationship between the rainfall of one month with that of subsequent months, particularly during the southwest monsoon. Such a study of intercorrelations for months April to September for all the meteorological subdivisions is available in the publication on Indian Monsoon Correlations.[1] The principal result is that deficient rainfall during any month of the monsoon season is just as likely to be followed in succeeding months by abundant as well as deficient rainfall and vice versa. Inter-correlation coefficients (cc) exceed 0.30 only in a small number of cases. There is no significant inter-correlation between August and the other monsoon months. However, there are a number of significant cc's between individual monsoon months and the monsoon season as a whole. Sample tables for East Uttar Pradesh, Madhya Maharashtra and Tamil Nadu are given in Appendix 13.1 - Statement VI. We now refer briefly to the degree of association or correlation among the various Meteorological subdivisions of the country for the southwest monsoon season as a whole. These are shown in Appendix 13.1 - Statement VII. A significant feature is that Assam rainfall is negatively correlated with that of most of the Meteorological subdivisions or the cc is not significant. Another point is that in general, neighbouring or adjoining subdivisions are significantly correlated but this does not extend far. Such information would be helpful for grouping together areas in connection with seasonal forecasting in the country.

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[1] Rao K.N., Jayanthi S. and Bhargava V.K., 1972. Indian Monsoon Correlations - Part I Monthly Inter-Correlation for all the Meteorological Sub-divisions of India, Meteorological Monograph No.4, Climatology. India Meteorological Department.

Breaks in Rainfall in July-August

13.2.15 Breaks are periods during the southwest monsoon when there is considerable diminution of rainfall over large parts of the country. A major feature of the sea-level pressure map in the southwest monsoon months of June to September is the trough of low pressure which runs northwest to southeast from the Punjab to the head of the Bay of Bengal. During breaks the axis of the trough is close to the foothills of the Himalayas when westerly winds prevail over the greater part of the country. On such occasions there is considerable decrease in rainfall over most of the country. In a study[1] of breaks during the 80 year period 1888 to 1967, there were a total of 113 breaks, 53 in July, 55 in August and 5 in July-August. The study is based on analysis of past daily, weekly and monthly weather and related surface and upper air data. The frequency of breaks in each decade was as follows:

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[1] Ramamurthy K., 1969. Some aspects of the 'Break' in the Indian Southwest Monsoon during July and August, Forecasting Manual Part IV, 18.3. India Meteorological Department, Poona.

Table 13.2

Frequency of Breaks

Decade	July	August
1888-1897	8	9
1898-1907	8	6
1908-1917	10	9
1918-1927	6	9
1928-1937	1	7
1938-1947	4	3
1948-1957	8	7
1958-1967	7	5
total	53	55

There was significant decrease between 1928 and 1947 but in the last two decades the frequency has risen again. The average number of breaks is four in three years.

Duration of Breaks

13.2.16 The duration of breaks has varied from 3 to 21 days and half of them are of 3 to 4 days. Breaks of duration of 8 continuous days and higher form 20 per cent of the total in July and 24 per cent in August. The following data indicate that breaks of longer duration exceeding a week are not infrequent:

Breaks number of days	July % to total	August % to total
3-4	52	45
5-7	28	31
8	6	7
9 and higher	14	17

The total number of break days in the 80 year period was 306 in July and 356 in August. The average duration of a break is 3.8 days in July and 4.5 days in August. The distribution of total number of break days in ten days period of July and August is as follows:

Period	Total number of break days (1888-1967)
July	
1-10	81
11-20	117
21-31	108
August	
1-10	115
11-20	159
21-31	82

Break days are not uniformly distributed in the different ten days of July and the last ten of August. While there is near uniformity between 11 July to 10 August, the maximum is between 11 to 20 August with average of 2 breaks. This perhaps is the reason for the general impression of greater frequency of breaks in August in the country, though the above shows clearly that the average number of breaks is practically the same in July and August.

Rainfall in Break Periods

13.2.17 Because of the widespread decrease in rainfall it would be useful to know the order of this decrease in the different parts of the country. This is shown in Appendix 13.1 - Statement VIII for 12 break periods in the years 1951 to 1967 in the different meteorological sub-divisions of the country; the breaks of 4 to 12 days' duration during these years totalled 83 days. The mean percentage departure from normal was negative in all the sub-divisions except in north and south Assam, Sub-Himalayan West Bengal, Bihar Plains, ~~(+ 37%)~~, Rayalaseema ~~(+50%)~~ and Tamil Nadu ~~(+ 49%)~~. In eleven of the sub-divisions the mean departures ranged from -51 to -85 per cent. In order to give an idea of the distribution the number of rainy days expressed as percentage of normal and percentage departure of rainfall during the breaks are shown in Appendix 13.2 - Maps VIII and IX.

Spatial Distribution of Rainfall

13.2.18 While the above gives in idea of the average departures for the sub-divisions as a whole, it would be both useful and necessary to know the category of rainfall distribution also (widespread 76-100% of the stations in a sub-division, fairly widespread 51-75%, scattered 26-50% and isolated 1-25% of stations having 2.5 mm or more rainfall daily). These details were worked for the different meteorological sub-divisions and are shown in Appendix 13.1 - Statement IX. The categories scattered to dry account for 70 to 90 per cent in many of the sub-divisions. In Assam and sub-Himalayan Bengal the per cent of occasions of widespread and fairly widespread rainfall is over 80. Even in an area of good rainfall like east Madhya Pradesh only 21 per cent occasions were widespread and fairly widespread.

13.2.19 The above analysis is general and in view of importance of such a knowledge for agriculture and planners, it is necessary to analyse taluk data from this point of view and make the same available to all users. We recommend early action in the matter by the State Agriculture Departments in cooperation with IMD.

Temperatures

13.2.20 A major feature of distribution in space and time of normals of maximum, minimum and mean temperatures is the small extent of variations over large areas in the monsoon season. The variation in July mean temperature over most of the country is less than 5°C. Between July and August and in some areas July to September, the monthly averages differ hardly by a degree. What, however, would be needed most is the distribution of daily maximum and minimum temperatures to evaluate the frequency of high or low temperatures and their spells (heat waves, cold waves) too. This information would be useful in planning for different distributions of temperature ranges. We recommend that IMD should publish frequencies of daily maximum and minimum temperatures including spells of high or low temperatures for all the observatories with data of five years or more. Hourly data for a number of stations are now available for more than five years. These data are useful in knowing hourly distribution and thus the diurnal variation of temperature. Frequency of hourly values exceeding certain threshold figures necessary to know the duration in hours of different ranges of temperatures for application in cropweather studies.

13.2.21 The country has a reasonably good network of temperature recording stations for getting an idea of the distribution in space and time. Two main publications which give the averages are referred to. The climatological Tables of observatories in India (1931-60) issued by the IMD contains normals of (a) maximum and minimum temperatures and (b) dry and wet bulb temperatures for 0830 and 1730 hrs IST.

The publication also contains extremes of maximum and minimum temperatures based on all available data up to 1960. The climatological Atlas of India (Abridged) published in 1971 by IMD includes maps of (a) mean temperature and (b) maximum and minimum temperatures for January, April, July and October. In addition, maps of maximum temperature for May and absolute maximum and minimum temperatures are included. As the maps of extreme temperatures are based on data of 60 years or more, they could also be regarded as the highest, lowest temperatures ever likely to be recorded. These maps and data should be adequate for getting a general picture of range and the distribution of temperatures in the country. We understood that the stock of these basic publications is low and IMD should arrange for their republication early.

Sunshine

13.2.22 The duration of bright sunshine is an important factor affecting crop growth. It would, therefore, be useful to have a brief idea of its distribution[1] which is as follows:

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i) The daily average in January is more than 7 hours per day except in Kashmir. The western half of the peninsula and adjoining Gujarat areas has the highest average of more than 9 hours per day. Only in the extreme north and over Kashmir, the values are low and Srinagar average is only 2.5 hours per day. The low values in the extreme north may be attributed to the passage of succession of western disturbances during the winter season when clouding is also high. With the advent of summer conditions the duration of bright sunshine shows a general increase and the average in April is 9 to 10 hours per day over most of the country. The highest averages are over Gujarat and the adjoining regions of Rajasthan and Maharashtra.

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[1] Rao K.N., and H.R. Ganesan, 1972. Sunshine over India, Prepublished Scientific Report, India Meteorological Department, Poona.

ii) The pattern changes completely with the onset of the southwest monsoon in June and July. The west coast has an average of less than 3 hours per day. Bombay's average is only 2.5 hours. Assam and Bengal and the extreme southeast Madras have averages of 4 to 5 hours per day.

iii) By October, the southwest monsoon has withdrawn from most of the sub-continent. With a maximum of more than 10 hours over western Rajasthan, it decreases to less than 6 hours in the extreme northeast and southern parts of the sub-continent.

iv) The annual average duration of bright sunshine is 7 to 9 hours a day. The annual range of sunshine decreases from 5 to 7 hours in the Peninsula to 3 to 4 hours in northern latitudes. The average monthly duration is maximum in the Peninsula in February and during April-May in north India; it is minimum in the monsoon season. Diurnal variation is nearly similar at most stations with flat maxima between 10 to 15 hours local time and least in the monsoon seasons. Isopleths of hourly values show two ovals separated by a central zone of low values during monsoon months; this feature is not noted in Kashmir latitudes. A pronounced inverse relation exists between sunshine and cloudiness. The correlation coefficient between annual mean cloudiness and sunshine of 57 stations distributed all over the country is 0.76. The highest duration of sunshine recorded on any day so far is 12.5 to 13.3 hours to the north of lat. 20°N and 11.5 to 12 hours in the peninsula. The frequency of daily duration exceeding 9 hours is generally least during the monsoon. Sunshine is not a serious limiting factor over almost the entire country.

v) Maps showing the duration of bright sunshine and percentage frequencies of number of days of bright sunshine exceeding 9 hours for the months January, April, July and October and for annual are given in Appendix 13.2 - Maps X and XI. The present network is not large but is helpful in giving a fair idea of the average distribution in the different parts of the country.

13.2.23 Solar radiation is an important factor in crop studies but observational data in this country are very limited. The network has only recently been expanded and a summary of the available data is contained in a paper[1] on Global Solar (T) and Diffuse Solar Sky Radiation. The main features are described below:

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[1] Rao K.N. and Ganesan. H.R., 1972. Global Solar and Diffuse Solar Sky Radiation Over India. Monograph, Climatology, No.2, India Meteorological Department, Poona.

i) The annual mean of global solar radiation ranges between 400 and 500 cal/cm^2 and mean daily values are maximum in March, South of lat. 13°N and in May elsewhere. It is minimum in July-August over western monsoon area and in November in the east and north latitudes. The annual mean diffuse solar radiation ranges between 175 to 200 cal/cm^2. This is maximum in the monsoon and least in winter. Diurnal variation of global solar radiation is practically the same at all the stations with flat maxima between 11 to 13 hours and atleast in the monsoon months. Diurnal variation of diffuse solar radiation is similar but in magnitude is only a small fraction, one fifth to half of global solar radiation. The highest global solar radiation recorded is 625 to 700 cal/cm^2 in latitudes south of 20°N and 700-800 cal/cm^2 north of 20°N. The highest diffuse radiation is of the order of 400 cal/cm^2.

ii) Mean daily global solar radiation and diffuse solar sky radiation are shown in Appendix 13.2 - Maps XI (a) and XI(b) respectively.

Winds

13.2.24 Surface winds in the country are generally weak, mean daily wind speeds being less than 10 to 15 km per hour, excepting along Saurashtra Coast where they are stronger. Strong or high winds are mainly in association with cyclonic storms, depressions, thunder or dust storms, squally weather along coasts etc. There is clear difference between the strong or high winds in thunder-squalls and in cyclonic storms. The former are momentary gusts while in the latter the duration of high winds is much longer. The strong winds due to cyclonic storms along some part or the other of our coastal belts are almost a regular annual feature; only recently, we had the storm which struck Saurashtra Coast

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causing severe damages estimated at several tens of crores of rupees. The maximum wind speeds estimated in the cyclonic storms is 150 to 250 km per hour. Most of the information is estimated as the number of anemographs recording wind continuously throughout the day, is not large. The northwesters of Bengal are well known and speeds in gusts in the squalls have exceeded frequently 60 km per hour. In severe thundersqualls speeds of 160 km per hour have been recorded. Thundersqualls are generally localised and the very high winds in gusts last only for a few minutes as compared to storms. Considerable damage occurs to crops when winds with high speeds blow over an area - lodging of crops, creation of conditions favourable to frost when air is cold, increase in evaporation when air is hot and dry, loss of water in reservoirs due to high evaporation etc. and by transpiration from plants and trees. To check the ravages due to high winds, wind shelters have been proposed. Considerable work has been done in USA, USSR and other countries in this field and generally these studies have been found helpful; windbreaks have helped increase yields in grain crops by 20 to 80 per cent and 100 - 200 per cent in some grasses in the USSR. The major beneficial effects due to wind breaks[1] have been stated as follows:

i) checking air movement and thus affording protection to fields and orchards;

ii) checking of the movements of top-soil and consequent prevention of strong winds in areas where the soil is sandy or very fine;

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[1] 1962. Weather and the Indian Farmer, Indian Meteorological Department.

iii) reducing evaporation from free water surfaces and transpiration from the vegetation by reducing windspeed;

iv) providing shade to farm stead, and

v) providing timber and fuel as older trees are replaced by younger ones.

In recent years the network of anemograph stations has considerably increased and processed data to meet the varying agricultural needs in the form of means frequencies of wind speeds in different ranges, frequency of duration of windspeeds in various ranges etc. should be published by IMD.

Weather Phenomena

13.2.25 Information on frequency of thunder, hail, dust storm, squall etc. is collected from observatories of the IMD and of hailstorms from a wider network. Averages and frequencies of these are available in the Climatological Tables of observatories referred to earlier. Most of this information is supplied by part-time observers with the result that their dependability is less. It has been observed that the frequencies recorded by full-time staff differ much from part-time observatories. In recent years, the network of stations with full-time departmental staff has considerably improved and the new set of normals and frequencies when published should improve the position.

Climatic Change - Trends and Periodicity

13.2.26 The problem of trends and periodicity in Indian climate has always attracted and continues to attract attention. Questions pertaining to this aspect have been raised even at the highest level of Government. Considerab work in the field of trends has been done in the country, but most of it is in respect of individual stations only. In dealing with areas, a common difficulty has been the lack of data computed on a uniform basis;i.e., using the same set of normals and the same number of stations. A first requirement is therefore the publication of complete series of data of all stations with records of 70 years or more and preparation of uniform series for the various meteorological subdivisions of the country. This work is necessary so that a detailed analysis may be made for the country as a whole using both individual stations with long records and also for the various meteorological sub-divisions. These would also be helpful in examining correlations among the various seasons and sub-divisions in greater detail and for grouping similar areas.

13.2.27 Periodicity in weather has also been examined in a limited way, but so far there is no significant support for any definite period. A recent analysis[1] of rainfall series in Madras, for 158 years (the largest in the country) shows that there is no trend or periodicity. We feel that the data recommended for being compiled in the preceding paragraph of this Section when ready, would enable detailed examination with a view to arrive at dependable conclusions.

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[1] Rao,K.N. and V.K. Raghavendra, 1973. Time Series Analysis of 158 years' Rainfall of Madras (India) (Period 1813 - 1970). Meteorological Monograph, Climatology, No.7, India Meteorological Department, Poona.

13.2.28 The above studies have been limited to rainfall mostly and also to the use of statistical techniques. But the problem of climatic change and climate prediction is much broader and is a global problem too. The subject of global decrease in temperature in recent decades is engaging the attention of a number of distinguished scientists all over the world and international symposia and discussions have recently been held to review the present position and explore possibilities of climate prediction. Unless we get to a better understanding of the physical processes and causes involved in climatic variation, the problem of prediction will continue to be difficult and complex. In the meantime the subject would have to be attacked by all possible approaches dynamic, physical and statistical. All these will need considerable time, effort and concentrated attention. In view of the importance of climatic prediction to agriculture we recommend that the study of climatic change and prediction be taken up as a project by the Indian Institute of Tropical Meteorology (under the Ministry of Tourism and Civil Aviation) in cooperation with the Meteorological Department, ICAR and other interested Ministries/Departments of the Government of India.

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3 AGROMETEOROLOGY

Meteorology and Crop Production

13.3.1 Quantitative studies on crop-weather relationship attracted attention in the beginning of the century when certain data were collected on groundnut and cotton crops in Egypt and interpreted in terms of weather factors. This was followed by a comprehensive crop-weather study on wheat in Britain (1922). The broad object in these studies could be said to have been whether the plant itself can be used as an indicator of its own yield. It is not difficult to visualise that the play of weather factors starts right from the time the seed is put in the soil. Every weather sequence favourable or adverse, has its impact on the growth and development of the plant. The easiest way to visualise this is to examine any crosssection of a log of wood which contains many concentric rings, each of which represents an annual growth of vascular bundles, which are used by the tree for translocation of food material. The distance between any two rings is an indication of the type of weather which a particular tree has experienced in a particular year. Compared to the life of a tree, the life of a crop plant is very much shorter, but even in this case, the variation in height, the intensity of branching or the quickness or the delay in the time of flowering all vary from year to year depending upon the weather. It is generally estimated that weather as a single factor could be responsible for as much as 50 per cent of variations in yield which occur from year to year, the remaining 50 per

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cent being due to other factors like irrigation, manuring and plant protection measures etc. Although it appears so simple to visualise, when it comes to relating the play of weather factors on a crop plant quantitatively to various plant characters and the yield, the job becomes very complicated. This is because merely corelating the weather factors with the morphological features like the plant height, the number of leaves or branches, the number of flowers and so on does not represent the full story of the plant development. The real clue to the changes that occur in a plant lies in the bio-chemical activities. It is these bio-chemical activities which manifest themselves ultimately in various external features. Therefore, what can possibly afford an answer to the growth pattern which is found in a particular season is how the bio-chemical changes within the plant have been influenced by the weather. An ideal study should include the bio-chemical aspects also together with the measurement of external features for a clear answer of the inherent relationship between the plant and weather. This is precisely what B.A. Keen had emphasised in his presidential address to the Royal Society, London while commenting upon the British results (1940).

13.3.2 As stated earlier in section 1, crop-weather scheme was initiated in India around 1945 for collection of meteorological data in the farm environment and even inside crops simultaneously with the collection of data on certain selected crops. The crops chosen for the study on all-India basis were wheat, rice, jowar, cotton and sugarcane. The plant observations included the progress of germination as revealed by the number of seedlings observed per day after sowing, the height of plants, the number of tillers/branches, the time of flowering, the number of flowers in the case of cotton and the yield. The observations were taken by sampling. Canada also undertook this kind of study, but with fixed sampling. One major advantage which has decidedly accrued from the crop-weather scheme is that the country today has a network of more than a hundred well equipped agro-meteorological observatories situated within the environment in which crops are grown, viz., the experimental farms. These observatories record data on sunshine, air temperature (maximum, minimum, dry, wet and terrestial minimum thermometers), soil temperature, wind, rainfall, evaporation from water surface and evaporation from soil surface. Periodical measurements of soil moisture through gravi-metric method are also made at about 20 stations. A second advantage is that series of growth and yield data measured in a systematic manner on a common all-India pattern have been collected for about a dozen stations per crop for 20 to 25 years. The growth data represent measurements of meteorological features only. The meteorological and crop data have been subjected to various studies, but if the original question is posed even at this stage whether the plant has been utilised successfully as an indicator of its own yield, the answer is not yet definite. We feel that the ICAR should include in their future programmes work of bio-chemical studies for a fuller understanding of crop-weather relationship.

13.3.3 In the higher latitudes, besides soil moisture, temperature and sunshine are serious limiting factors for plant growth. Emphasis in their studies is, therefore, placed on thermo-periodism and photo-periodism and the concept of day degrees has consequently been developed which gives very clear results for those latitudes in any study involving plant and weather. In India, however, temperature and sunshine do not act as limiting factors in a given part for the crops which are commonly grown. For example, wheat a cold loving crop grows well in the northern areas but the temperature variations from year to year are not of such a magnitude as to bring about major changes in its growth pattern. Similarly, in the case of sunshine, one could expect about 7 to 9 hours of sunshine in clear seasons and even during the south-west monsoon period, there could be 3 to 5 hours of sunshine per day on an average over large parts of the country. Many crops can do well with diffused sunlight and, therefore, even in rainy season, less hours of sunshine do not adversely effect them. This would become apparent if one goes through critically all the crop weather studies which have been made so far utilising the data collected in the country. It is either the rainfall or the moisture deficit which comes out as the most important factor influencing the crop growth. At places temperature and sunshine have also been found to be significant contributors but there is no consistency in the results that the effect of temperature which has been found to be valid in one area is corroborated by all the areas where the same crop is grown. It seems difficult to visualise that the effect of a weather factor on a particular crop will be so particularised as to be applicable at one station and not at the other. What is intended to be emphasised here is that one has to be careful about spurious correlations and has to distinguish such correlations from the consistent ones which could be applicable to many places where the same crop is grown. If this test is applied to the data collected within the country, it would be satisfied only by rainfall.

13.3.4 The effect of sunshine, temperature or humidity etc. however cannot be ignored. In fact, whether it is the frigid latitude or the temperate or the subtropics or the tropics, plant would always need a particular set of circumstances representing the various weather elements. But, in our country, the towering influence of rainfall masks the other influences in practice when it comes to representing the results in a quantitative manner. What is, therefore, needed is to have a clear idea of the influence of individual weather factors on plant growth. In biological experiments, glass houses have been utilised in the past for conducting studies under controlled conditions. However, the glass houses are most suited to a few elements like the control of temperature and humidity. Sometimes attempts have been made to vary the light conditions also. But by and large, glass houses are not very suitable for this purpose. An improvement over the glass-house approach has taken place in recent times and is represented by the phytotrons. These are constructions of good size both in regard to length and breadth as well as height and are equipped to simulate weather with regard to a single element or a combination of various elements. Crop plants could also be grown within these phytotrons in the same manner as they would grow in a field. The IMD had once considered equipping its Agricultural Meteorological Division at Poona with such a phytotron. We feel that there is an urgent necessity to go in for such constructions not only in the IMD, but also in different agricultural universities, so that a clear idea of crop weather relationship under controlled conditions could be obtained. It will be only after such a step that it would be desirable to collect and study data on field scale.

13.3.5 It does not, however, mean that the efforts should be slackened to collect the kind of data both on crops as well as on meteorology under field conditions on an all-India basis as has been done under the crop-weather schemes. The building up of such series of data over a long period of time will enable the country to have normals of crop characters as well as meteorological factors collected simultaneously which should prove helpful to administrators, planners and research workers in many ways. Our studies (Chapter 14) on the distribution of monthly rainfall in the year have revealed that there are 174 rainfall patterns within the country. It is necessary that every zone representing a particular pattern of rainfall distribution must have one or more fully equipped agromet observatories depending upon its size etc.

Soil Moisture Observation Network

13.3.6 A serious handicap which has been noticed in regard to agrometeorological data relates to soil moisture. There is considerable emphasis on soil moisture storage within the soil in various kinds of estimates which have a bearing on water requirements for plant growth. In the absence of soil moisture measurements, this element is estimated on the basis of other related meteorological parameters. The estimates suffer from many assumptions and the greatest of all is the depth of soil, not to speak of the type of soil. There are hardly about two dozen stations in the country at present which take direct measurement of this element. Soil moisture varies from field to field, depending upon the texture, structure and depth of soil. There is, therefore, no short cut to having actual field soil moisture observations all over the country but it may not be practicable to build up such an extensive network covering about six lakh villages. One could, however, aim at building up a network of soil moisture determining stations up to the block level. As a first step towards that objective, a minimum target of building up a network of at least 3,000 stations,each covering a taluk, must be accomplished in the next few decades. Whereas the responsibility for agrometeorological observatories proposed in the above paragraph for every rainfall zone would have to be with the agricultural universities because of the highly technical nature of the measurements of various weather elements involved, the responsibility of soil moisture measuring stations should be that of the State Departments of Agriculture. They should also take steps to publish the soil moisture data.

Evapotranspiration Measurements

13.3.7 Evapotranspiration like soil moisture is a very important factor in crop growth. At present the data available on this element relate to computed values using theoretical considerations. The concept was introduced by Thornthwaite[1] in the USA, who utilised an empirical approach involving temperature and length of day. Penman[2] in 1948 developed a theoretical equation combining energy balance and aerodynamic considerations. The equation contains terms involving temperature, pressure, wind, radiation and saturation vapour pressure deficit. The energy balance and aerodynamic combination is now in extensive use in many parts of the world. Slatyer (1967) of Australia has also made significant contributions to this approach. Meteorological parameters are measured according to established standards. On the plants side the basic idea has been that a turf when maintained saturated with soil moisture could represent the maximum loss of water through the processes of evaporation and transpiration; which would take place from a given area of land. The mathematical equations have usually been checked against the direct measurements of evapotranspiration from such turfed surfaces. In some places, an estimate of evapotranspiration is made also on the basis of evaporation from water surfaces of various dimensions, the most standard being the 120 cm diameter USA pan with a depth of 30 cm. A Russian tank has even dimensions of as large as 5 m diameter and about 2 m depth. The general observation is that the evapotranspiration from any cropped area may be approximately taken to be 7 to 8 tenths of evaporation from a free water surface of a large expanse. The equations which have been developed on aerodynamic and energy considerations give a better idea of the evapotranspiration than this approach. In the absence of direct measurement on various kinds of plants and soils, computation from theoretical[1] considerations is the only recourse to arrive at a gross picture of water loss due to evapotranspiration. But how far this would remain tenable under various kinds of growth of plant communities as represented by various plants, orchards and plantation crops as also by the various field crops is difficult to guess.

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[1] Thornthwaite C.W., 1948. An approach toward a rational classification of Climate, - Geographical Review,USA, Vol 38, No.1.

[2] Penman, H.L., 1948. Natural evaporation from open water, bare soil and grass. Proceedings of the Royal Society, London, A193: 120-146.

13.3.8 Hohnel in Austria had tried to estimate evapotranspiration from potted forest saplings towards the close of last century (1878-1880). These data were utilized by Horton[2] in the USA to build up a relationship between the evapotranspiration and the height and girth of a given

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1. Rao, K.N., C.J. George and K.S. Ramasastry, 1971. Potential Evapotranspiration over India., Prepublished Scientific Report no 136. India Meteorological Department.

2. Horton, E.R.,1923. Rainfall interception Monthly Weather Review, Washington.51: 571-81.

tree. On transpiration alone, Briggs[1] and Shantz in the USA studied upto 55 species and varieties (1913-16) to determine the water requirements of crops. In India, J.W. Leather[2] made equally extensive studies on water requirements of potted plants in the beginning of this century (1910-11). The study of single plants in small pots has now given way to lysimeters of large sizes which can permit the growth of plant communities which are comparable in growth and height with the crops found under field conditions. The depth of lysimeters is also not a limiting factor so as to make the cropped area within it pot bound. Extensive studies of evapotranspiration should be undertaken in different parts of the country under varying conditions of soil moisture in different soils and using as many plant species as possible representing field, orchard, plantations and forest plants. It is only then that a real idea of evapotranspiration under plant conditions could be had. These studies would make it possible to indicate the contribution of individual factors like transpiration from plant surfaces and evaporation from soil surfaces in a planted area as compared with the evaporation from bare soil and evaporation from free water surface. As a first step fundamental research should be conducted at all the agricultural universities and the Central institutes of the ICAR as well as at the Forest Research Institute, Dehradun on this subject. Once the studies made at these centres result in certain standard procedures, a wider network of

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[1] Briggs, L.J. and Shantz, H.L., 1914. Relative Water requirement of Plants. Plant Journal of Agricultural Research (Washington), III(1): 65.

[2] Leather, J.W., 1910. Water requirements of Crops in India, Memoirs of the Department of Agriculture, India. (chemical series), 1(8).

evapotranspiration centres throughout the country will have to be planned to obtain an idea of actual evapotranspiration through direct measurement under different climatic and odaphic conditions. IMD has planned a network of about two dozen evapotranspiration stations which would take up observations with certain selected plants on a common methodology; but these evapotranspiration centres are being set up on the basis of whatever work has been possible at one single station, namely, the Central Agricultural Meteorological Observatory, Poona. The pace of setting-up of these stations need not be interfered with, but this should also not be a reason to stall the study which is being suggested by us in various research centres because we are keen that the observations on evapotranspiration must be tried after involving as many plant species and as many different soil moisture conditions as possible. When this is done, the time would be opportune for establishing evapotranspiration stations at least at every district headquarters.

Phenology

13.3.9 Phenology is a field of science which relates to the study of recurrence of an event in the life history of living being, be it plant or animal. Britain has been systematically collecting data on the migration of birds for several decades . . In India one is familiar with the appearance of cuckoo in advance of the south-west monsoon. It has always been considered by farmers as a precursor to the onset of the monsoon. Studies on tagging birds have also been taken up by a few orinthologists. Insofar as plants are concerned, the IMD arranged a study of observations on the flowering of certain selected plants, i.e., mango, *neem*, *babul* and tamarind. Phenological observations have been continued by the IMD for many years. In the case of mango, the severity of winters during December determines the intensity of flowering around February insofar as north is concerned, for the bearing ~~of~~ naturally depends on the intensity of flowering. The severity of winters is associated with the number of western disturbances which pass through the north-western parts of the country. In the rear of the western disturbances which move across the northern parts of the country, temperatures are considerably lowered. Whether it is merely the effect of temperature or the associated precipitation which encourages subsequent flowering of mango needs further examination. Such studies could throw light on certain weather phenomena at crucial times which could give an early idea of the yield which is to be had from a crop or a tree. For this reason, it is desirable that the network of phenological observatories in the country should also be strengthened so that there is atleast one in each taluk. As the observation need for study is the noting of the time of occurrence of a particular phenomenon like flowering or any other characteristic of plant growth, the collection of such statistics should not present much difficulty. What is to be guarded against is that the selection has to be of nature-grown plants. In the case of cultivated plants, breeding for a particular purpose (including earliness or lateness artificially), changes the natural biological rhythms. Therefore, if cultivated plants are to be selected, it is to be ensured that the network of these phenological stations must take observations on the same variety of plants so that the data collected does not suffer from non-comparability. There should not be any difficulty for such a simple observation to be recorded at taluk headquarters. The responsibility for collecting and publishing the results of these observations should lie with the State Departments of Agriculture, who should make these available to other user interests.

Pests and Diseases

13.3.10 The sporulation in the case of fungus diseases or hatching of eggs in the case of insects is very much controlled by the temperature and humidity conditions. Similarly, the growth, specially in the early period, of the pathogens as well as insects, is greatly controlled by these two elements. In laboratory, the measurements are usually made under petridish conditions. These, however, do not have any relevance to the field conditions and, therefore, when the results are applied to field conditions, these often fail. Although it appears obvious that many of the pests and diseases are weather controlled, the quantitative evidence under field conditions become very difficult. Clear examples of the influence of weather on pests and diseases are rare but one of the pests which could illustrate the role of weather is represented by the wheat rusts. It is now well known that it is the trajectory of upper level winds which determine the outbreak of rust epidemic in different parts of the country. The IMD has attempted to collect data on the incidence of pests and diseases in a qualitative manner e.g., whether a pest or disease has been noticed in

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a particular year at a particular agricultural research station and whether the incidence has been low, medium or high. The data are available on a number of crops for many years, but these are qualitative. The Commission on Agricultural Meteorology of the World Meteorological Organisation has addressed itself to this vital problem of study of weather in relation to diseases and pests of various crop plants including potato blight, apple scab and wheat rusts. They have prepared reviews of existing methods and indicated their practical applications and the criteria which could be adopted for warnings of disease and pests. The subject is largely in an exploratory stage. The IMD has also drawn up a scheme to intensify studies on diseases and pests of crop plants as related to weather. However, we would like the involvement of all the agricultural universities and the Central institutes of the ICAR in this task. There has to be a get together of the plant pathologists, entomologists and the agricultural meteorologists to determine a basic line of approach towards which all the efforts of the country should be directed. The responsibility for organising such a common approach should rest with the ICAR. The study should not only include the relationship between the weather and various pests and diseases under field conditions but also a surveillance service based on meteorological observations. These studies shoul prove useful in forecasting the epidemics so that the farmers could take timely control measures.

Meteorology in relation to Orchards, Plantations and Forests

13.3.11 Efforts have been made in the IMD to study the micro-climates obtainable in various crops including sugarcane and betelvine. These two crops represent the conditions obtainable with tall plants and fruit plantations. It will be interesting to note that under the conditions of any afternoon in clear season, the micro-climate which is found under the conditions of a tall crop like sugarcane is very different from what obtains in the open. In the open, ground surface is the hottest near noon and temperature decreases with height in the airlayers with which plants are primarily concerned. What happens in a sugarcane field is that the hottest surface exists just over the canopy of leaves and temperature decreases with height both above and below the canopy. In other words, a dense crop like sugarcane indicates a condition in which the active surface is shifted from the ground to the canopy and within the crop the temperature increases above the ground surface until the canopy height is reached. Whereas there are unstable conditions in the open, stable temperature conditions persist within a sugarcane crop. What happens in the case of sugarcane is also applicable to thickly populated orchards. The utility of such a knowledge can very well be imagined from a simple fact that whereas dusting and spraying under unstable conditions would mean a wastage of chemicals, the stable conditions represent their efficient utilization. If a farmer is aware of the distinction, he can modify his strategy so as to make the best use of the costly plant protection chemicals. Micro-climate found within a field can also be utilised to control the pests and diseases once it becomes known what is the density of plants which is conducive or otherwise for their proliferation. A knowledge of the micro-climate of plant communities can also help to determine the density which is necessary to optimum growth and yield. The same objective could very well apply to orchards and forests.

13.3.12 While a good number of agrometeorological observatories in the country have been located on the farms, the observatories in orchards, plantations and forests are not adequate. We recommend that this lacuna should be removed as quickly as possible. As far as orchards are concerned, a beginning could be made in the gardens and plantations located in the research institutions. In the second stage, an attempt should be made to have at least one such observatory in every district.

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Forest Meteorology

13.3.13 A knowledge of the forest-climate interaction is essential, as the WMO have pointed out, for understanding and assessing the extent of modification of climates due to the conversion of tropical and sub-tropical forest areas into agricultural lands. In arid and semi-arid regions particularly, denudation of forests may affect the water-balance of the country. Very little work has been done in India on forest-climate interaction. In Chapter 44 on Forest Ecology and Wildlife Management, we have referred to a study on the climatic deterioration resulting from disforestation. Other studies in this field are available in the annotated bibliography on forest influences and watershed management research in India published by the FRI in 1970. However, a coordinated effort is necessary to review, assess and plan the future work in this direction. We recommend that the IMD should in consultation with the Forest Research Institute, Dehradun and the State Forest Departments review and assess the present position in the country and draw up a long term research programme in forest meteorology. The network could be determined by the Forest Research Institute, Dehradun keeping in view the ultimate objective of establishing one which would give representation to forest conditions in different agro-climatic regions of the country.

Hill Meteorology

13.3.14 The pattern of farming in hill and mountain areas is different from the one followed in the plains. Cultivation in hilly areas is possible in valleys and over slopes. Plots are usually small and over slopes: these are arranged in terraces girdling the hill at various points of its elevation. Fruit or plantation crops and paddy are commonly grown in such areas. The choice of fruit or plantation crops as also of the field crops, other than rice, varies according to region. Temperate fruits of various kinds are the speciality of the belt comprising Kashmir, Himachal Pradesh and West Uttar Pradesh Hills. Tea is common in the Himalayan West Bengal and Assam. Pineapple is the fruit grown in Meghalaya, Manipur and Tripura. Tea, coffee, rubber, cashewnut, pepper, cardamom, clove, nutmeg are the specialities of the southern hills while coconut and arecanut are usually grown on flat lands in the valley. The common arable crops are rice, maize, small millets and potato. Despite this kind of choice being available, there is a temptation to give preferential treatment to paddy and fit it in all kinds of elevations disregarding the fact that water needed is really available for this crop only in the valleys. This brief description is meant to illustrate that there is no scientific pattern of cropping most suited to different elevations. The micro-climate over hills varies very widely depending upon various factors. The hill facing the ascending side of the monsoon winds is cooler, has more moisture and is, therefore, more lush green than the other side over which the wind descends. The duration of sunshine varies widely over small distances due to the directional orientation in general and due to the shadow effect of nearby hills in particular. Moreover, there is the valley effect where the valley acts as a pool for cold air and is covered with fog. The sequence of horticultural plantations as well as arable crops requires to be determined after taking into account all these meteorological considerations and the knowledge in India at present on these aspects is meagre. There is, therefore, a need to pay greater attention to research work as well as agricultural developmental work specially directed to the problems of hill areas.

Meteorology in Relation to Livestock Production

13.3.15 The application of meteorology to livestock production can be studied in three ways. These are: (a) how the macro-climate obtainable in a particular place affects the productiv of different kinds of animals (b) how micro-climate obtainable in paddocks and barns affects the health of animals kept there and (c) what is the contribution of meteorological factors in the spread of animal pests and diseases. Animal Husbandry scientists at various centres including the Indian Veterinary Research Institute, Izatnagar, have made several studies in relation to climate. Some of the prominent research institutes are also having their own meteorological observatories, but in the context of the livestock production and its future plans, the present meteorolocal set up exclusively for livestock is very inadequate. There is need for all the institutions dealing with animal research and dairy, piggery and poultry organisations to arrange for meteorological observations which are considered essential for their work. There is also need for conducting micro-climatic studies within the paddocks and barns, which will give an idea of the level of animal comfort that is conducive to higher production. The general purpose meteorological observatories should not, however, be confused with the observatories which are to be set up for productive animals. Just like crops, it is very necessary that the observatories are set up in the very environment in which the animals are reared and confined. The responsibility for setting up and maintaining these should rest with the respective institutions and departments.

Weather and Animal Diseases

13.3.16 Studies in recent years have shown practical links between current weather and the epidemiology of diseases of farm animals. A review of the work in this field given in a recent technical note of WMO on 'Weather and Animal

Diseases'[1] covers subjects like the wind-borne types such as fowl pest and foot and mouth disease and parasitic and fungal diseases etc. Among the conclusions, it is stated that much can be done with existing systems of weather recording with small cost-benefit ratios. Details are given in the annexes to this publication of the prediction systems which are now in use or under operational test in the United Kingdom. Work in this field in India seems to be limited, but the importance of the subject from the practical economic point of view is considerable. Research needs the combined efforts of animal husbandry scientists and meteorologists.

Remote Sensing Techniques

13.3.17 The World Meteorological Organisation has drawn attention to the use of remote sensing techniques in providing means of rapidly collecting a variety of agro-meteorological data. As examples, reference is made to (i) large scale colour photography supplying supplementary information on the condition of crops, pastures and forests, (ii) large differences in vegetation cover, physiography and drainage patterns provided by remote sensing images. It is desirable to examine the extent of application and usefulness of these techniques for utilisation in this country. We have dealt with this briefly in Chapter 61 on Statistics - Remote Sensing Techniques.

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1. Smith, L.P., 1970. Weather and Animal diseases, WMO Technical Note No. 113, World Meteorological Organisation (WMO) Geneva, Switzerland.

4 DROUGHTS

13.4.1 Departures from normal rainfall occur frequently but when deficiencies are large, widespread and/or prolonged, drought conditions set in. Definitions of drought vary widely with the area of interest. More than 60 definitions have been listed in a report on assessment of drought. Palmer (USA) defines drought as an interval of time, generally of the order of months or years in duration, during which the actual moisture supply at a given place consistently falls short of the climatically expected moisture supply. The US Weather Bureau defines drought as a period of dry weather of sufficient length and severity to cause at least partial crop failure. In a report to the Administrator, National Oceanic and Atmospheric Administration on the influence of weather and climate on United States grain yields, prepared in December 1973, the definition of agricultural drought is given as follows: "A combination of temperature and precipitation over a period of several months leading to a substantial reduction in yield (bushels per acre) of one or more of the major foodgrains (wheat, Soyabean, corn). A "Substantial reduction" is defined as a yield (bushels per acre) less than 90% of the yield expected with temperature/precipitation equal to long term average values". But rainfall, while it may be a major criterion, does not give the complete picture and a lower rainfall that would be fatal to crops in one region might be sufficient for growth in another. Besides rainfall, factors like intensity of evaporation, sunshine, soil, stage of crop growth etc. have also to be taken into account. Thornthwaite defines drought as a condition in which the amount of water needed for transpiration and direct evaporation exceeds the amount available in the soil. Some of the other definitions in use are:

i) According to the British Rainfall Organisation a partial drought is a period of more than 28 days with a very small rainfall per day and absolute drought is a period of at least 15 consecutive days during which the rain does not exceed 0.25 mm.

ii) The objective method for specifying drought suggested by the Australian Bureau of Meteorology is to specify the minimum water need for a particular purpose. Drought occurs when rainfall during an interval is less than the minimum water need.

iii) In USSR drought is defined as a period of ten days with a total rainfall not exceeding 5 mm.

Drought classification

13.4.2 Droughts may be broadly classified into the following three types:

i) Meteorological drought: It is a situation when there is significant (more than 25 per cent) decrease from normal precipitation over an area.

ii) Hydrological drought: Meteorological drought, if prolonged, results in hydrological drought with marked depletion of surface water and consequent drying up of reservoirs, lakes, streams and rivers, cessation of spring flows and fall in ground water levels. Hydrological drought may be reflected in depleted snowmelt due to poor snow-fall in an earlier season and this may result in curtailment of power generation and affect industry as well as agriculture.

iii) Agricultural drought: It occurs when soil moisture and rainfall are inadequate during the growing season to support healthy crop growth to maturity and cause extreme crop stress and wilt.

Drought studies in India

13.4.3 Drought is an occasion when the rainfall for a week is half of the normal or less, when the normal weekly rainfall is 5 mm or more. Agricultural drought is a period of 4 such consecutive weeks in the period from middle of May to middle of October or 6 such consecutive weeks during the rest of the year. Seasonal drought occurs when the actual seasonal rainfall is deficient by more than twice the mean deviation. Subramanyam and co-workers made use of the aridity-index of Thornthwaite and drought years were classified as moderate, large severe or disastrous according as the departure of the yearly aridity index from the climatic normal value was less than ½ σ, between ½ σ and σ, between σ and 2 σ, or above 2 σ respectively, σ being the standard deviation for the set of data employed. The Drought Research Unit of the IMD at Poona, has tried to evolve a drought index on the basis of rainfall departures, monthly rainfall deciles, water periods etc. Employing Thornthwaite's water balance technique, and using potential evapotranspiration values computed[1] for 300 stations from Penman formulation, areas of arid and semi-arid climatic zones were demarcated.[2] Saurashtra-Kutch region of Gujarat, the western half of Rajasthan and parts of Haryana are in the arid zone where there is constant water deficit. Conditions very close to aridity prevail in the rain-shadow tract along the leeward side of the Western Ghats from Nimar in Madhya Pradesh through the districts of Khandesh, Ahmednagar, Sholapur (Maharashtra), Gulbarga, Bijapur, Raichur and Bellary (Karnataka) to Anantapur, Kurnool and Mahbubnagar districts (Andhra Pradesh). A small area within this tract around

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1. Ibid, 1, (p.54).
2. Rao, K.N., C.J. George and K.S. Ramasastry, 1972. Agro-Climatic Classification of India, Meteorological Monograph, Agrimet no.4, India Meteorological Department, Poona.

the Anantapur - Bellary chord also has conditions of aridity. Semiarid regions comprise areas where precipitation meets only one-third to two-thirds of the evapotranspiration needs. These regions cover almost the entire Peninsula east of the Western Ghats and extend to portions of West Madhya Pradesh, West Uttar Pradesh, Haryana and Punjab. Semi-arid conditions occur in parts of Gaya, Patna and Monghyr districts of Bihar. On the lines of work done in USA by Palmer, computations involving detailed hydrologic accounting were carried out for different meteorological sub-divisions for the period 1901-1969. The drought climatology[1] of the country thus prepared shows that on an average, drought may be experienced over large areas on 20-25 per cent occasions in each of the months of the kharif season. For identification of drought areas, IMD has defined drought as a situation occurring in any area in a year when the annual rainfall is less than 75 per cent of the normal. When the deficiency of rainfall is above 50 per cent of the normal, it is termed as 'severe drought'. Areas where droug has occurred in 20 per cent of the years during the period are considered 'drought areas', and where it has occurred in more than 40 per cent of years, as 'chronic drought areas'. This definition of drought does not however, take into account the distribution of rainfall so important from the point of view of agriculture. In view, however, of the differences in cropping patterns and distribution of rainfall from region to region, it is difficult to qualify the definition of drought

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[1] Goroge C.J., K.S. Ramasastri and G.S. Rentala, 1973. Incidence of Droughts in India, Meteorological Monograph, Agrimet No 5. India Meteorological Department, Poona.

with sufficient exactness by introducing this element and needs detailed study. Using the annual and south-west monsoon rainfall departures from normal during the period 1901 to 1960 for about 500 stations drought areas have been identified by the IMD. The Irrigation Commission accepted this approach and in their Report (1972) indicated the drought and chronic drought areas as follows:

i)	drought areas (20 per cent probability of rainfall deficiency of more than 25 per cent of normal)	Gujarat, Rajasthan and adjoining parts of Punjab, Haryana, West Uttar Pradesh and West Madhya Pradesh.
		Madhya Maharashtra, Interior Mysore, Rayalaseema, south Telangana and parts of Tamil Nadu.
		a small portion of north-west Bihar and adjoining east Uttar Pradesh.
		a small portion of north-east Bihar and adjoining portion of West Bengal.
ii)	chronically drought affected areas (40 per cent probability of rainfall deficiency of more than 25 per cent of normal).	West Rajasthan and Kutch.

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13.4.4 Thus, most of the areas identified as susceptible to drought fall within the arid and semi-arid zones mentioned above. Chronically drought affected areas are identical with the intensely arid zone. All the districts which comprise the drought zone are not equally vulnerable to crop failures as protective irrigation has been developed in some of the districts or taluks. As such those of the districts/taluks which enjoy a minimum percentage of irrigation should appropriately be excluded from the list of drought affected areas.

Drought Prediction

13.4.5 The question whether drought can be predicted from rainfall or drought data series over an area from a knowledge of trends, periodicity etc. is of considerable importance. Rainfall series of stations in the country generally exhibit random nature and have shown no significant trend on the whole. Some of the long rainfall series have been tested for periodicity also but none of significance has been noted. In addition, spectral analysis[1] of Palmer Drought Index series, referred to earlier in this Section, available for a number of meteorological sub-divisions has been tried. These show some relation to quasi-biennial oscillation and in some cases to sun-spot cycles. The amplitude of the cycle is, however, too small to be of significance. We are not alone in arriving at such results. Professor H.E. Landsberg, President, WMO Commission for Special Applications of Meteorology and Climatology in his lecture in Geneva in June 1974 on 'Drought' has expressed almost identical views in this regard as may be seen from the extract reproduced below[2]:

"Data analysis of long records of precipitation in various parts of the world did not indicate any radical one - sided trends but rather fluctuations which might persist for several years. Spectral analysis revealed no well-defined cycles of rainfall anywhere but a widespread irregular rhythm

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[1] Rao, K.N., C.J. George, P.E. Moray and N.K. Mehta, 1973. Spectral Analysis of Drought Index (Palmer) for India, Indian Journal of Meteorology and Geophysics Vol 24, No. 3, pp 257-27

[2] Landsberg, H.E., 1974. Drought - Summary of Lectures and Discussions, Geneva June 1974. WMO Bulletin, XXIII (4): 226.

of two to three years was in evidence. The analysis at the same time did not preclude entirely the presence of a weak rhythm in the 11 to 13 years spectral band which might identify with, the solar cycle. This point required further exploration".

13.4.6 The problem of quantifying drought still remains. The water balance technique is a useful approach as it takes into account precipitation, evapotranspiration and soil moisture storage and attempts to arrive at a balance between water gain and water loss. Actual observational data are lacking and water balance and other computations would have to depend for a long time to come on data calculated from theoretical considerations.

13.4.7 The Indian National Committee for the International Hydrological Decade has set up a sub-committee on Water Balance to make an assessment of water of the Indian river basins and to recommend broad outlines of future work including research studies to be undertaken. The work of this sub-committee should prove useful in the drawing up of definition of drought and future programmes of research.

13.4.8 It should be clear from the above that the approach of trends,cycles, periodicity etc. is not feasible for forecasting drought. A statistical study of rainfall or drought series could help in evaluating probability of different rainfall amounts of drought values and useful in indicating the risk of low rainfall and attendant drought in the various areas of the country. However, comprehensive and systematic study of all past droughts by dynamic and synoptic - climatological methods both for a better understanding and for forecasting droughts is an urgent need. We recommend that this important project may be taken up jointly by the IMD and the Indian Institute of Tropical Meteorology in cooperation with ICAR. We have also dealt with some aspects of drought forecasting under Extended Range Forecasting later in this Chapter.

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5 WEATHER BULLETINS FOR FARMERS

13.5.1 Besides rainfall, other weather phenomena such as occurrence of abnormally low or high temperatures, cloudiness, high winds, hail, etc. are of importance to agriculture for protection against frosts, regulation of spraying of pesticides and protective measures against wind or hail damage.

Present Service

13.5.2 The IMD initiated an experimental programme of issuing farmers' weather bulletins in the 1930's. A regular weather service for farmers on a regional basis commenced operation in 1945. This consists of bulletins of actual and expected weather for each district for 2 or 3 days, issued daily by the five regional meteorological centres (RMC) at Bombay, Calcutta, Madras, New Delhi and Nagpur and meteorological centres (MC) at Jaipur, Lucknow, Gauhati, Hyderabad, Bangalore and Trivandrum. Similar Centres are proposed to be started at Srinagar, Bhubaneshwar, Patna and Ahmedabad. Warnings of adverse weather such as cyclonic storms, strong winds, heavy rains, hail, frost etc. are also included in these bulletins. These bulletins are translated into local languages and broadcast by various regional stations of All India Radio in their rural programmes. The bulletins are broadcast in the rural programme for the farmers through about 1,50,000 community radio sets all over the country.

Crop Weather Calendars

13.5.3 For the guidance of the Meteorologists who issue these forecasts, statewise crop-weather calendars in respect of each major crop for each climatologically homogeneous zone have been prepared by the Agricultural Meteorology Division of the IMD in consultation with the crop specialists of the States. The crop-weather calendars[1] were first prepared in the 1940's and are now being revised to take into account the requirements of newly introduced varieties of crops and changes in cropping practices. The calendars depict the normal dates and duration of various phases of the crop and indicate the weather conditions of significance in each phase and a forecast of which will be of use to the farmers. While compiling the calendars, requirements given by the State authorities have been interpreted in terms of practical forecasting capabilities. In order to enhance their utility, we would suggest that separate calendars should be prepared for early, normal and late sown varieties of each crop in different zones. We are aware that compilation of calendars for varietal differences in crops would pose serious problems as inter-annual variations in weather cannot be adequately allowed for. Nevertheless, a start in this direction is desirable. For preparation of the calendar, information in respect of individual research farms all over the country may be useful. It would also be necessary to include in the crop-weather calendars information on crops like soyabean, safflower, sunflower, cow-pea, etc. which have assumed increasing importance in recent years.

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[1] 1962. Weather and Indian Farmer, India Meteorological Department, Poona.

Limitations and Required Improvement

13.5.4 The bulletins for farmers issued daily give only meteorological information in a general way and, in addition, include forecast on the type of weather likely to be experienced in the different districts of a meteorological region. From the farmers' point of view such a bulletin could not be of much use because it gives no indication of the steps the farmer should take in the light of a particular type of forecast valid for the next 24 or 48 hours. He would particularly need advice on the following:

i) whether he could sow a particular crop when the requisite rainfall may be expected;

ii) whether he should delay his sowing operation because the rainfall is not likely to occur;

iii) whether he should resort to irrigation to save his standing crop because of expectation of a drought spell;

iv) whether frost is expected and if so what measures he should adopt to save his crop; and

v) whether humid weather is expected around the flowering time so that he could take plant protection measures in order to save the crop at such a crucial time from the effects of certain diseases or pests etc.

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It does not take time to realise his difficulty and therefore, before a particular weather bulletin is framed and issued for broadcast on the All India Radio, a joint discussion among the plant scientists, agricultural meteorologists and the forecasters is considered essential. A suggestion was put forward by the IMD to the State Departments of Agriculture that at the time when the forecast is being drafted they may send their representatives for discussions. This task has become simpler after the formation of the

State Meteorological Centres in recent years. There is close collaboration and coordination between the officials of the Department of Agriculture and the scientists of the agricultural universities and the respective State Meteorological Centres in the States of Karnataka and Tamil Nadu in the preparation of the daily weather bulletin. We strongly recommend that a common pattern on an all-India basis for a daily joint discussion between the plant scientists and meteorologists should be drawn up on the basis of the experience of these two States and that this should be compulsorily extended to all the States. Joint daily meetings between plant scientists and the meteorologists has recently taken another very useful direction. The latter half of 1975 saw the launching of the SITE programme (through which the television facilities have been extended to a network of about 2,500 stations spread all over the country), which includes also a feature advising farmers on agricultural operations in relation to weather. For this purpose, an Agricultural Meteorologist of the India Meteorological Department and representative of the ICAR everyday sit with the forecaster at the Northern Hemispherical Analysis Centre of the IMD at New Delhi and decide how the forecast should be oriented and telecast so as to be useful to farmers. In the light of the anticipated weather, the nature of operations the farmer should undertake with regard to sowing etc. or plant protection measures are all spelt out in the telecast programme. This is a welcome development and we hope that in course of time it will become a regular daily feature.

Improvement in Dissemination

13.5.5 Farmers' weather bulletins are at present translated into regional languages and integrated into the rural programmes broadcast over stations of All India Radio, usually once a day. The bulletins should preferably be broadcast by AIR twice a day in the morning and evening during periods of high listener preference. Similar broadcasts could be made on television wherever such coverage is available. District agricultural officers may be assigned the responsibility of regularly listening to farmers' weather bulletins and sending to the Directors of Agriculture and the IMD offices in each State, periodical reports of their evaluation on the effectiveness of the bulletins and give their suggestions for improvement. They should particularly highlight instances when the operational farmers' weather bulletin helped or failed to help in protecting crops from the adverse effects of weather. This kind of feedback is necessary for effecting improvements in the agricultural weather service. The IMD should evaluate each year the performance of the farmers' weather bulletin service and present the same at conferences of agriculturists at the State level for discussions between scientists as well as the users. The ICAR should consider convening such periodical conferences for evaluation of weather service to farmers and for their improvement.

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13.5.6 An important problem concerns the communication facilities available at present for the dissemination of weather forecasts and warnings for agriculture. It is recognised that the present position is very inadequate and needs significant improvement but the setting up of an exclusive communication network for the purpose does not appear feasible at present.

Weekly Crop-Weather Bulletins

13.5.7 While the above arrangements serve the daily needs, it is necessary that each State should prepare a weekly crop-weather bulletin containing a descriptive statement on week's weather and crops, temperature and rainfall of observatories in the State and a forecast of weather a week ahead. The responsibility for the compilation and issue of the weekly bulletin should be that of the Director, Bureau of Economics and Statistics of the State and where such an organisation is not responsible for agricultural statistics, it may be of the Director who performs similar functions. In the preparation of the bulletin the Director will be assisted by the local Meteorologist, the representatives of the Director of Agriculture and the local agricultural university. The weekly bulletin should be issued on the same day in the week as that of the weekly weather report by the IMD. While enabling a close watch to be kept on week's weather and agricultural conditions, it will also help educate its agricultural community in getting acquainted with weather and agriculture in a more intimate manner. An effort in this direction has already been made by Karnataka, whose weekly bulletin format etc. is given in Appendix 13.1 - Statement X as a sample.

6 EXTENDED RANGE FORECASTING

13.6.1 Forecasts of weather for two days with outlook for subsequent two days are at present issued with reasonable degree of confidence. For longer periods say a week, a month and season, the problem continues to be one of great complexity. A few countries issue such forecasts but the general solution has defied attempts so far. The need for such forecasts for agriculture is, however, very pressing. It may be relevant to state that the forecasting of monsoon rainfall a season in advance, formed one of the important recommendations of the Indian Famine Commission even earlier than 1880. A brief reference to the efforts made in India is given in the subsequent paragraph.

Seasonal Forecasting - India

13.6.2 India has been issuing seasonal forecasts of monsoon rainfall for over 80 years and the method followed for the last 50 years is the correlation approach. Factors likely to be associated with Indian rainfall have been examined on global basis but only a few factors have shown significant correlation and fewer still have maintained their original significance. The factors thus selected have been fitted into a linear regression equation which is used for prediction. The factors and the regression equation are periodically examined for significance and new factors introduced to maintain significance, as and when necessary. Three seasonal forecasts are issued every year covering (i) the southwest monsoon months of June to September.

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(ii) August and September and (iii) the winter months of January to March. For (i) and (ii) the areas covered are the Peninsula and northwest India and for (iii) northwest India only. Details including areas covered, factors employed, dates of issue etc. are given in Appendix 13.1 - Statement XI. As the formulae have varied, only the actual performance against the forecasted value has been verified and it is found to be about 70 per cent. While the performance is not striking, it cannot be regarded as unsatisfactory either. The forecasts are, however, of limited utility as they cover vast areas and the multiple Correlation Coefficients (CC) of the regression equations are in the range of 0.68 to 0.75 only.

Long Range Forecasts

13.6.3 A helpful approach for prediction of rainfall a year ahead or for longer periods could be by detection of trends and/or periodicity in long term records of rainfall Studies of a number of stations in the country have with minor exceptions (Konkan) not revealed any significant trends or periodicity. A quasi-biennial oscillation of nearly 2 years has been noticed in rainfall series over many stations in the country. These and indications of eleven-year periodicity akin to sun-spot cycle have, however, small amplitudes, not large enough to have significant influence on the total rainfall regions. One would, therefore, have to try other methods.

Dynamic Climatological Techniques

13.6.4 With availability of large-sized electronic computers and magnetic data storage facilities in the IMD, development of medium and long range forecasting techniques should be attempted with high priority. This could be done (i) by intensive correlation studies involving a large number of factors - surface, upper air and possibly extra-terrestrial, (ii) by deriving statistical and semi empirical formulations for smaller areas and for smaller intervals of time and (iii) by use of dynamic climatological methods. In the third method, a set of derived meteorological parameters like vorticity, vergences, wind shears, vertical motion etc. have to be computed from average and daily data. These parameters have to be used with known and tested physical relations and prognostications attempted. Statistical analysis of derived parameters from such prognostic studies may then be tried. For medium range forecasts Numerical Weather Prediction (NWP) techniques should be evolved for forecasting precipitation, temperature anomalies, etc. upto 5 to 7 days.

World Weather Watch

13.6.5 Under the World Weather Watch (WWW) project of the World Meteorological Organisation, the world meteorological centres at Washington, Moscow and Melbourne would be preparing forecasts for extended periods ranging from 5 days to a month or more, with the aid of large computers. The regional Meteorological Centre of WWW at New Delhi has facilities to obtain these forecasts from the world meteorological centres on fast

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telecommunication channels. It also receives global meteorological data as well as cloud imagery relayed from orbitting meteorological satellites round the clock. An IBM 360/44 computer has been installed at this Centre and should be used for experimental extended range forecasts for India and neighbourhood upto 5 days with the aid of the large amount of data obtained through WWW channels.

Monsoon Experiments

13.6.6 Our knowledge of many aspects of the Indian southwest monsoon on which a large part of Indian agricultural production depends is even now far from complete. A special experiment (MONEX) has been planned as a part of the Global Atmospheric Research Programme (GARP) jointly by the World Meteorological Organisation (WMO) and the International Council of Scientific Unions (ICSU). The first phase of the programme started during the monsoon of 1973 in collaboration with USSR and four research ships of USSR and two of India participated in this phase. The study will be intensified during the first GARP Global Experiment (FGGE) to be conducted jointly by WMO and ICSU during 1977. A Geostationary Meteorological Satellite (GMS) is planned to be launched by USSR over the equator at 70°E and will keep a constant watch over the weather over India and the surrounding areas with capability to relay pictures of developing cyclones or advancing monsoon clouds once every 20 minutes. A variety of new techniques are being evolved to obtain data on winds, temperatures, humidity etc. from all over the globe during GARP. With the help of these technological developments and large computers it should be possible to obtain more definite knowledge of the physical processes of the Indian SW Monsoon by the end of this decade and develop reliable techniques for medium range and long range forecasts of its advance, pulsations and withdrawal for the use of agricultural community.

13.6.7 In view of the large and complex problems involved we strongly recommend that research into the various aspects of the subject including those outlined above should be given priority. The entire range of subjects could be grouped under Extended Range Forecasting and work distributed among the IMD, Indian Institute of Tropical Meteorology, and other interested institutions. Sufficient funds should be made available by Government and an advisory group should be set up under the chairmanship of the Director General of Observatories, with membership from Meteorological Department, ICAR, IARI and Agriculture Departments of the States to periodically review and draw up concerned programmes for speedy implementation.

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7 CROP WEATHER RELATIONSHIP

13.7.1 A number of research institutes and organisations are at present engaged in the study of crop - weather relationships. Certain biochemical aspects of crop-weather relationships have been referred to in Section 3. The IMD is studying various aspects of drought, forecasting of crop yields, dry farming etc. A Crop Weather Studies Unit has been set up in the Directorate of Economics and Statistics in the Ministry of Agriculture and Irrigation to concentrate on the publication of long term comparable data on crops and weather, derivation and computation of rainfall indices, analysis of crop weather relationship between weather and crop production etc. The IARS and the IARI are engaged in experimental work on crop weather relationships. Some of the agricultural universities have also been engaged on studies in this important field.

Weather Parameters and Crops

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13.7.2 Crops are greatly dependent on weather during the periods of growth and particularly in the critical phases like germination, flowering, seed setting, manuring etc. For healthy growth and good yields, certain optimum conditions of rainfall, temperature, wind, sunshine, soil moisture etc. are essential. However, the problem is complex and much work would have to be done to arrive at dependable relationships in quantitative form between these factors and yields of crops. Such studies are being actively pursued in many countries. In the USA crop yield studies are made using regression techniques, both linear and curvilinear. In addition to weather factors, technological trend is used both in its linear and quadratic forms. In the USSR crop yield forecasts, using curvilinear techniques, are issued. Besides weather parameters, soil moisture, stage of crop development, soil type and evapotranspiration are also considered. Instrumented aircraft are employed to obtain information on average as well as on the state of growth of the crops. Ninety per cent success has been claimed. Research work in this field is being done in Canada and Australia also. In India data collected under the All-India Coordinated Crop Weather Scheme introduced in 1945 have been statistically analysed using the techniques of regression, Fisher's response curves, fitting of probability distributions of meteorological factors and Ezekiels' curvilinear regression. The studies have brought out the relatively large dependence of crop growth and yield on rainfall and its distribution in various phases compared to other meteorological parameters. At Niphad (Maharashtra), Dharwar (Karnataka) and Powerkheda (Madhya Pradesh) rainfall above normal in the month preceding sowing and in germination phases has been found to have beneficial influence on wheat yield. At Niphad and Jalgaon (Maharashtra) an idea of the final yield of wheat could be had from the nature of germination and shoot growth when the crop is two months old. An early study on the influence of rainfall distribution on cotton yields at Akola and Jalgaon has shown that an additional inch (2.54 cm) of rain in the fourth week of May has an adverse effect. Heavy and continuous rainfall in the latter half of July and the first half of August affects the yield adversely as it gives rise to weeds and water logging and delays weeding and interculture operations. Heavy rain at the end of September or the early part of October damages the cotton crop by causing the shedding of bolls. These and various other studies were carried out with data from experimental stations over limited periods. They were also severely conditioned by non-availability of uniform data over long periods. Added to these are the diversity of farming practices in the country which limited the extension of field experimental results for assessment of overall crop yields.

Crop Yield Formulation

13.7.3 After the droughts of 1965 and 1966, the IMD on the recommendation of the Planning Commission set up a unit in the latter half of 1967 for investigations on drought climatology and for developing techniques for issue of crop yield forecasts using meteorological parameters. The work involved detailed statistical analysis to isolate the critical periods in weather factors which have significant association with crop yield. These are combined to derive linear regression equations and used for forecasting yields of crops. In the case of rice, the distribution of rainfall during the crop growing season is found to be the most crucial weather parameter; temperature plays only a minor role. For wheat, pre-season precipitation and distribution of temperature during crop growing season are important. Minimum temperature between $5.6^{o}C$ and $7.2^{o}C$ and maximum temperature not exceeding $21.1^{o}C$ are generally conducive to better wheat yield. Critical periods when weather elements significantly affect yields of rice are given in Appendix 13.1 - Statement XII. Formulae have been developed for 22 sub-divisions of the country for quantitative yield forecast of rice, 6 for yield of wheat, 2 for yield of bajra and 5 for jowar in dry farming area. Tentative forecasts for kharif rice are framed in August, September and October and final forecasts in November. Work on similar lines is being carried out at the IARS on the basis of data from six experimental stations. It has been found that rainfall during the period January to April has contributed significantly to the yield of the wheat crop. A study of the response of yield to rainfall indicated that in un-irrigated tract the rainfall was beneficial to the growth of the crop during the entire crop season, while in the irrigated tract the rainfall during the months of December and March had a damaging effect on the crop.

13.7.4 In the case of rice, the rainfall in July is beneficial to the crop while in August it has some adverse effects. Similar studies were also conducted in respect of jowar, cotton, groundnut and barley. It was noticed that about 90 per cent of the variation in yield was explained by the variation in rainfall in the case of cotton and groundnut while this variation was of the order of about 45 per cent for jowar and barley.

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Crop Yield and Rainfall Distribution

13.7.5 The Institute of Agricultural Research Statistics, New Delhi, has carried out linear regression analysis with yield as the dependent variable and total rainfall during the five crop growth phases as independent variables. About 47 per cent of the variation in wheat yield was due to variation in the rainfall during each period. Rainfall during pre-sowing, flowering and grain formation period was more important and effective as compared to rainfall in other periods. In Raipur district of Madhya Pradesh, the total rainfall for the months of June and August does not have much effect on rice production, but the total rainfall during the months of July and September has greater influence on the crop yield. During the month of July a deficiency of the order of 16 per cent in rainfall showed an adverse effect on crop production, while the corresponding percentage in the month of September was of the order of 13 per cent. The above findings have been confirmed from the physiological point of view also. Computation showed that a deficiency of the order of 16 per cent or more might be observed once in three years. This could happen for two consecutive years once in sixteen years. The data were also examined to study the pattern of occurrence of rainfall with the help of Markov Chains for the crop season - June 1 to September 30. Probabilities of a day being wet or dry depending on weather conditions on the previous day were thus computed.

Rainfall Indices

13.7.6 It has been observed that there are considerable variations in the amount of rainfall received within a State or even a district. Further, there are variations in the amount of rainfall received within a crop season in a particular area. The Directorate of Economics & Statistics of the Union Ministry of Agriculture and Irrigation, have initiated the compilation of rainfall indices for different crops and groups of crops. The actual rainfall in a particular month or season is expressed as the percentage of the normal. Only those regions/States are considered where the crop is grown to an appreciable extent. Further, only the period of the growing season – from preparatory tillage to harvesting – is studied. In the case of rice, rainfall indices for 9 States, accounting for about 90 per cent of the total production of rice, have been worked out by weighting the individual State/Sub-Division during 1964-65, which was a normal year. Similarly, for wheat, rainfall indices have been constructed for the period September-April for 6 States, accounting for about 92 per cent of the total production of wheat in the country. For all the foodgrains considered together the rainfall indices for each of the four season viz. Monsoon (June-September), Post-Monsoon (October-December), Winter season (January-February) and summer (March-May) have been constructed by combining the indices for 12 States accounting for about 90 per cent of the total production of foodgrains in the country. These indices have been compiled from 1950-51 onwards. It is proposed to correlate yields/production with these indices to enable (i) an assessment of the effect of rainfall on the yield/production of individual crops, and (ii) forecasting of crop yield/production at different stages during a crop season. A limitation of this method is that equal weightage has been given to the monthly rainfall during the entire life cycle of a crop. Further, a month may be too long a period to adequately cover the life cycle of a crop. It is, therefore, suggested that (i) periods smaller than a month should be considered for construction of rainfall indices; and (ii) a system of weights should be developed on the basis of experimental data to combine the rainfall indices during the different phases of crop growth. A study should be conducted to determine the variability in weekly, fortnightly and monthly indices.

Contribution of Technology to Crop Production

13.7.7 It is generally difficult to isolate the contribution of technological development and favourable weather to increased crop production. However, taking into account the available data,

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which is scarce, it may be possible to arrive at an estimate of their relative magnitudes. Such a study could profitably be undertaken in rainfed areas of the country. Studies on crop-weather relationships by the IMD indicate that in the case of rice-yields the percentage variation accounted for by technology varies from 4 to 46 per cent in different regions. The percentage variation in the yield of rice accounted for by the technology alone for some of the sub-divisions of the country is given in Appendix 13.1 - Statement XIII. The upward trend due to advances in technology - improved seeds, fertilizers, pesticides, etc. is discernible in many areas especially after 1950. In the case of Tamil Nadu and Andhra Pradesh, an earlier technological trend is noticed from 1906 to 1920 presumably due to extension of irrigation facilities.

Physiological Response of Crops to Weather

13.7.8 For a better understanding of the crop-weather relationship it is necessary to assess the physiological response of crop to weather. Towards this objective, firstly intensive measurements of micro-meteorological parameters would have to be made for an assessment of water balance and energy budget in crop environment. These experiments spread over a relatively short period of about five years have to be replicated in space and time at a number of places close to one another. These measurements have then to be evaluated in laboratory experiments under controlled conditions. Secondly, climatic data collected from meso-scale network have to be applied to solve practical problems of a farm area of several hundred to several thousand hectares. Data thus collected should be used to (a) explain fluctuation of yield, (b) select times of planting and harvest and (c) guide irrigation scheduling and other cultural operations. Thirdly, data collected on macro-scale could be used in development of formulae for forecasting crop yield.

13.7.9 Crop weather studies by the IMD should be intensified and forecast formulae developed on a district-wise basis taking into account such additional factors as soil moisture, irrigation, consumption of fertilisers, and area under high yielding varieties. Further, such relationships would have to be continually revised to suit the changing conditions.

13.7.10 Efforts should be made to collect detailed data on acreage, yield, etc. according to (a) varieties,

(b) irrigated and un-irrigated, and (c) various cultural practices like drill sown, transplanted, broadcast, etc. so that it may be possible to arrive at more precise crop-weather relationships. Efforts should also be made to attempt forecasts of acreage under crops on the basis of climatological march of weather and other factors like prices of competing crops.

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8 WEATHER MODIFICATION

Basic Considerations

13.8.1 Even during rainless spells in the monsoon, the atmosphere has as much precipitable water in some places as during active periods and extensive clouds may pass over a region without precipitation. Cloud seeding is the technique by which clouds could be induced to precipitate on such occasions. In 1938, the feasibility of rain stimulation and hail suppression through the introduction of artificial sublimation nuclei into super-cooled clouds was established by Findeisen, on theoretical grounds. Interest in the work remained obscure till 1948 when Schaefer used dry ice particles as artificial ice crystals to stimulate rain on a deck of super-cooled altocumulus clouds and Vonnegut found that silver iodide particles, being similar in crystal structure to ice were, more effective than dry ice at temperature below 3°C. Since the mechanism of formation of rain in 'warm' clouds (above 0°C temperature) is through coalescence of water droplets, use of hygroscopic nuclei like common salt and Calcium chloride which aid the production of large size water droplets, are found to be effective. Seeding is best done from aircraft flying inside the cloud. It can also be done, but in a less effective manner, from nuclei generators located on the ground. Condensation nuclei, mostly silver iodide or dry ice (solid carbon dioxide), have been used to seed clouds in the temperate countries. Hygroscopic nuclei, mostly common salt or Calcium Chloride, have been employed in the tropics.

Cloud Seeding Experiments

13.8.2 Beginning in 1947 cloud seeding experiments have been carried out in Australia, USA, Japan, USSR and Israel and the results are summarised below:

(i) Australia: Experiments have been conducted in five locations since 1947. Of these at only one location was a significant increase in rainfall noted. At three locations there was definite decrease while in the fifth region there was an increase of only 4 per cent in the precipitation.

(ii) USA: Cloud seeding on strict scientific lines was begun in 1952. Preliminary results of some of these indicated increase in precipitation. The experiments carried out in Florida for drought alleviation, indicated that nearly 50 per cent of the total rainfall came from seeded clouds. But instances of decrease in precipitation following seeding have also been reported. Dynamical cloud seeding of individual clouds by massive injection of seeding material by pyrotechnic devices have been conducted since 1964 in Florida, California and the Carribean. The technique is an improvement of the normal cloud seeding methods in that it aims at the release of latent heat of fusion by freezing the supercooled water droplets above the freezing level in clouds, thus inducing the cloud to grow and deposit its rain content. The growth can be vertical as well as lateral and the results could be spectacular. In a recent experiment on drought mitigation in Florida by dynamical cloud seeding, it was estimated that the benefit-to-cost ratio was as high as 31:1. Rainfall of about 100,000 acre feet was attributed to the seeding.

(iii) Japan: During the period 1947 to 1960, cloud seeding trials have been carried out by major universities. About 20 per cent increase in precipitation in a five-year ground based experiment was reported. The trials of warm and cold seeding carried out from 1961 to 1967 have led to mixed results.

(iv) USSR: Rain making is considered as a proven success in the USSR where the total number of personnel working in the field runs into thousands. The experience gained in the field of rain making is now being made use of for the purpose of fighting forest fires. The experimental and operational cloud seeding projects in USSR make use of both conventional and dynamic seeding techniques. Thunderstorm dissipation project was started in the early sixties. The powders used for seeding clouds are finely powdered cement and Cupric Oxide. Seeding operations were accomplished from aircraft by flying at heights ranging from 6 to 12 km. Ordinary aircrafts were used for flying in the lower height range and jet aircraft in the higher height range. About 200 clouds were seeded over a period of 5 to 6 years. The amount of cement used for seeding ranged from 5 to 10 kg in Cumulus Congestus and to 40 kg in a thunder cloud. Within 10 to 20 minutes of the injection of material into Cumulus Congestus, the cloud either dissipated or transformed into altocumulus. In the case of thunder clouds, the dissipation took place within 30 minutes of seeding. In both the cases, the material was introduced from the top of the cloud. Better results were noticed when the top of the cloud consisted of supercooled drops. The cloud tops ranged in temperature from 20°C to 35°C. Experiments conducted in the winter stratus clouds (clouds top - 18°C) whose depth varied from 2 to 3 km indicated negative result.

(v) Israel: In the trials conducted from 1961 to 1966, positive increase in precipitation has been noticed every year. An overall increase of 18 per cent was indicated. For the interior areas alone, the increase was 29 per cent.

Artificial Rain-making Experiments

13.8.3 With the aid of ground based Silver Iodide generators experiments were conducted by some private companies on the Western Ghats during the year 1951-53. Seeding with the aid of aircraft was also attempted by a few State Governments. There was, however, no attempt on the part of any of the rain makers to conduct experiments on a scientific basis to answer the question whether the showers that occurred after the seeding cloud have occurred even without it. The first conference of scientists to consider the problems of artificial rain-making in India was held at Delhi in 1953 and on its recommendations, a Rain Research Unit was started in 1955 at the National Physical Laboratory, Delhi. It is now a part of the Indian Institute of Tropical Meteorology at Poona. Experiments using warm cloud seeding have been conducted, on randomised basis, from ground; 4 monsoon periods at Jaipur (1960-63), 6 monsoon periods at Agra (1960-65) and 9 monsoon periods at Delhi (1957-61, 1963-66) in the plains of north India. The seedings were also carried out from aircraft during the monsoon period (1962) at Delhi. Orographic clouds were seeded for two summer seasons (1964-65) over the Munnar hills in South India. An increase of 20 per cent in the season's rainfall could be attributed to the ground based cloud seeding. Cold cloud seeding from ground based generators has been conducted at Delhi for three successive winter seasons. The number of seedable occasions available being small in each winter, the experiments will have to be continued for some more seasons before dependable conclusions become possible. A scheme for conducting ground based seeding experiments near Madras and seeding to the leeward of the Western Ghats by using common salt in a finely powdered form has been sanctioned. In this year,(1975), ~~could~~ cloud seeding was tried in Madras area and in Karnataka also.

13.8.4 Hail Suppression: Another field of interest in weather modification in India is hail suppression. Extensive damage by hail is caused to horticultural crops like apple orchards and rabi wheat in the ripening stage in Punjab, Haryana, Himachal Pradesh, Jammu & Kashmir and part of Uttar Pradesh during the winter, pre-monsoon and post-monsoon seasons. The method used for suppressing hail is over-seeding, which aims at production of more ice crystals to serve as potential hail-stones which together with the naturally created ones grow only to a limited size thereby considerably reducing the damage. The seeding is done with the help of aircrafts or by firing rockets to release seeding material into clouds. In USSR where the most spectacular results of hail suppression have been reported, estimates of the benefit-to-cost ratio are said to vary from 5:1 to as much as 17:1 depending on the region. While demonstrable evidence is available for an increased stimulation of rainfall in the seeded areas, the possibility of indiscriminate seeding leading to a decrease in rainfall over the target area also exists. The position regarding hail suppression seems much less convincing. Since the synoptic meteorologist is unable to forecast the occurrence of precipitation or hailstones from any given unseeded cloud, clouds have to be selected by random sampling for seeding, thus increasing the difficulties in assessing the results of cloud seeding. Use of computer models, along with the use of radio-active nuclei, observations by radar and by a ground observation network in the target area could aid in the acquisition of reliable data to ascertain the efficiency of seeding.

13.8.5 Development of Seeding Agents: Apart from the Conventional Silver Iodide the IITM, Poona has succeeded in developing mixture of AgI and some iodates which are capable of producing glaciation at temperatures close to 0°C. The ashes of 'khair' plants grown in Haryana have also been found to be effective as seeding agents.

13.8.6 Economic Aspects: The increase of 10 to 20 per cent in precipitation in situations where rain would have fallen in the natural course is indicated by the ground based seeding experiments in India. Cloud seeding will be of some value in relieving drought and can lead to significant improvement in crop yields, if carried out successfully at critical periods. It has been estimated that a 1 per cent increase in precipitation in hydroelectric catchments will compensate the cost of the cloud seeding operations, while in purely agricultural regions increases of as much as 5 per cent in precipitation may be required to pay off for the operations. As mentioned earlier, the technique of dynamic cloud seeding holds promise as a reliable method of producing artificial rain when suitable clouds exist.

WMO's Views

13.8.7 In connection with the above it is relevant to refer here to the statement issued in June 1974 by World Meteorological Organisation (WMO) in Geneva. While surveying the present position they emphasised that weather modification was still largely at the research stage and operations should be undertaken only after the most careful study by experts of the particular situation on the understanding that the desired end-results may not always be achieved. The full statement is given in Appendix 13.1 - Statement XIV.

Future Plans

13.8.8 The 1972 drought focussed the attention of Government and scientists to initiate weather modification experiments in the country at an early date. The Union Minister of science and technology held a meeting with scientists in May 1973 to discuss the feasibility of existing techniques as a result of which it was recommended that experiments should be undertaken during the next two to three years using both the inexpensive ground based seeding technique developed in India and the sophisticated dynamical cumulus modification techniques developed in USA. Keeping in view the WMO statement, we recommend that it is essential and urgent to strengthen both

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the research and operational aspects of the present organisation in the IMD and the Indian Institute of Tropical Meteorology to enable them conduct further trials and experiments for the next two to three years to arrive at dependable conclusions.

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9 RESEARCH, EDUCATION AND TRAINING AND INTERNATIONAL COOPERATION

Research

13.9.1 Several problems involving research, analysis and investigation in the field of agrometeorology have been mentioned in the preceding Sections. In addition some more are indicated below.

Mathematical Simulation Modelling

13.9.2 In recent years investigations are in progress on mathematical simulation modelling in agrometeorology for the quantitative evaluation of the effects of agrometeorological factors on the condition and productivity of agricultural crops. This is a welcome development. The present state of work in this field needs review for application of such models to Indian data and conditions. IMD in consultation with ICAR should work out a joint programme of study using this approach.

Production Functions for Crop Yields

13.9.3 The Planning Unit of the Indian Statistical Unit, New Delhi, has been engaged in studies on production functions for crop yields with dated inputs of irrigation water. For studying economically optimal use of water it is necessary to know the shape of the crop response function to different quantities of water used by the crop throughout its growth cycle. An important factor in this is the soil moisture release curve which is used as an indicator of actual yield. Evapotranspiration data are important in all these studies but lack of actual observational data has necessitated the use of computed values based on a number of assumptions. According to a paper on wheat[1] prepared by the Planning Unit, the results seem encouraging even after use of computed values of evapotranspiration. It is desirable that such studies are extended using actually observed evapotranspiration values which are becoming available at some stations and in their absence use of recent computed values.

Irrigation Evaluation

13.9.4 A study[2] has been made on the estimation of direct returns from supplemental irrigation of a monsoon rice crop as part of a broader objective to determine whether irrigation water in Raipur district of Madhya Pradesh might be profitably reallocated to a wheat crop during the arid months of the year. The analysis is detailed and uses probability considerations. Pan evaporation data have been used as a first approximation of paddy evapotranspiration. The estimated water need during September - October stress period is a minimum of 17 cm and maximum usable of 33 cm. The general conclusion on the basis of conditions as prevalent at the time was not favourable for reallocation hypothesis. It would be uneconomical to allocate water applied as supplemental irrigation on monsoon paddy to irrigated dry season wheat. It has been observed in the preface to this study that the author and his family lived in the area for fifteen months and collected the requisite data after careful scrutiny and checking. This considerably enhances the value of the study. Studies of the above type are desirable for a proper evaluation of irrigation and yield relationship of crops.

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[1] Minhas, B.S., K.S. Parikh and T.N. Srinivasan, 1973. Towards the Structural of a Production Function for Wheat Yields with Dated Inputs of Irrigation Water. Discussion paper no. 59, Planning Unit, Indian Statistical Institute, New Delhi.

[2] Thomas F. Weaver, 1968. Irrigation Evaluation under Monsoon Rainfall Patterns - A case study for Raipur District. Madhya Pradesh, India. Cornell International Agricultural Development Bulletin 10, New York State College of Agriculture.

Agroclimatalogical Maps.

13.9.5 During the past few decades, considerable volume of agrometeorological data have been collected and some of it has also been published. The time seems opportune to carefully examine and review the feasibility of preparation and publication of an agroclimatic atlas giving at least essential agroclimatic maps. Requests for such maps are also reported to be on the increase as there is at present no such suitable Atlas. It is understood that the IMD has plans for publication of such an atlas. The contents of the proposed atlas should be worked out in detail in consultation with ICAR and Directorate of Economics and Statistics, Ministry of Agriculture & Irrigation so that it would serve as a source of reference to a wide class of users. The stress in the Atlas would no doubt be on maps having a close bearing on agriculture. In this connection it may be mentioned that the Commission for Agricultural Meteorology of WMO at its Sixth Session held in October, 1974 has appointed a Rapporteur on

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Agroclimatic Maps[1] to examine the problems of different scales and to make proposals for the specifications of agroclimatic maps. It would be very desirable that the specification drawn up by the IMD should conform as far as practicable with those of WMO.

Education and Training

13.9.6 In our Interim Report on the Establishment of Agrometeorological Divisions in Agricultural Universities, we have recommended as follows:

(i) A Division of Agricultural Meteorology should be started in every agricultural university and certain other selected universities and central institutions which have the requisite facilities.

(ii) The Agrometeorology Division should deal with meteorological research of biological nature and also teach agricultural meteorology at all the levels.

(iii) ICAR should establish and finance the Agrometeorological Divisions in the Universities and also draw up the qualifications for staff and syllabi for the various courses.

(iv) Every Agrometeorological Division should have a well equipped first class field observatory.

13.9.7 We have recommended the opening of a large network of soil moisture, phenological and other types of observational stations. With such large numbers, inservice training of staff in practical observational work assumes considerable significance. The need is for training of lower level staff consisting of undergraduates and Secondary School Certificate holders who will be required to man large number of raingauges, soil moisture and other observational stations. The inservice training should be arranged by the concerned organisations in consultation and cooperation with the agrometeorology division of the IMD. Specialised training as required should be arranged in consultation with the IMD. In all these training programmes, cooperation and coordination between State agricultural organisations and IMD are essential.

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[1] Abridged Final Report. 1975, Sixth Session of Commission for Agricultural Meteorology, Washington 14-25 October, 1974. WMO No.402. Secretariat of the World Meteorological Organisation, Geneva, Switzerland.

International Cooperation

13.9.8 The World Meteorological Organisation is a Specialised Agency of the United Nations Organisation and the Commission for Agricultural Meteorology is one of its eight technical commissions. The permanent representative of India on the World Meteorological Organisation is the Director General of Observatories of the IMD. The technical commissions hold their meetings once every four years. In the past a representative from the IMD used to be deputed to attend the meetings. The Commission for Agricultural Meteorology held its Sixth Session in Washington from October 14-25, 1974. The subjects discussed included methods in agricultural meteorology, meteorological factors and agricultural production, modification and control of the agricultural environment, drought and agriculture, meteorological aspects of soil degration and fertility, forest meteorology, weather forecasting for agriculture, weather and climate and food production, economic benefits of agrometeorological services and training and symposia in agricultural meteorology. One of the major items was climate and food production. The importance of the subjects discussed both from the meteorological and agricultural points of view needs no emphasis. Rapid developments are taking place in science and technology and international meetings afford valuable opportunities for mutual exchange of views and discussions. In a field so vital as agricultural meteorology we recommend that every effort should be made to depute agrometeorologists also to the Commission's meetings.

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10 ORGANISATION OF METEOROLOGICAL OBSERVATORIES AND RAINGAUGES FOR AGRICULTURE

13.10.1 The India Meteorological Department has a wide network of about 500 synoptic observatories for recording various weather observations. Besides, there are a number of hydrometeorological observatories for collection of basic hydrometeorological data for planning river valley and flood control projects. In addition, there are about 50 agrometeorological stations maintained by different State agriculture departments that provide on a routine basis simultaneous meteorological and biological information regarding growth and yield of important crops as well as weather experienced by the crops during their life cycles. Another 70 auxiliary agrometeorological stations recording meteorological observations in farm areas are maintained by State and Central agricultural institutions. There is also a network of about 4400 rain-gauge stations maintained by the various State Governments whose data are received or arranged to be received by the IMD at Poona. Besides, there are about 3600 raingauges maintained by railways and other official agencies in different States, whose data are at present not being published in the State Rainfall Tables.

13.10.2 Meteorological data and forecasts cater to several categories of interests. The network density of meteorological observatories varies according to the requirements of the user interests. To meet the increasing demands for weather data for operational purposes and for research into various aspects of agriculture including also animal husbandry, horticulture, forestry, fisheries etc., there is need for a complete and early review of the existing network by the respective State and Central departments and organisations concerned. The programme for future meteorological network for agriculture including animal husbandry, forestry etc. should have unified development under three broad headings viz., (a) micrometeorological observatories in selected areas for the understanding of the basic physical interaction between the plant and its environment; (b) meso-scale climatic network designed to provide farmers information to improve their agricultural operations and (c) macro-scale regional networks designed for better weather forecasting capability. The rainfall organisation in the country will have to be considered along with these. We have recommended elsewhere in our Report that there should be well-qualified agricultural personnel even at taluk level. The observatories to be opened should be manned by qualified agricultural staff to ensure the accuracy and reliability of the observations. We have already referred to the need for soil moisture observations from each taluk atleast. The rainfall organisation is now reviewed with suggestions for its improvement.

Rainfall Registration in India

13.10.3 It should be clear from the preceding sections that rainfall is vital to agriculture. Rainfall statistics are obviously, therefore, extremely valuable to agriculture scientists, planners and administrators.

The IMD were recently consulted about the present set up of rainfall organisation in India. The following are the main points:

(i) Rainfall registration in India is governed by the 1890 Rainfall Resolution of the Government of India. In accordance with this Resolution, the subject of rainfall registration in the country was brought under the technical control of the IMD; the various State Governments are responsible for the following items: (a) the maintenance and inspection of all raingauge stations under their control; (b) the recording and collection of rainfall data from these stations; (c) the regular publication of such data for the use of the public; and (d) the supply of special printed statements of daily and monthly rainfall in prescribed forms to the IMD for the compilation of the two annual publications viz. the 'Daily Rainfall of India' and 'Monthly of Annual Rainfall of India'. The Director General of Observatories, IMD is responsible for (i) the technical advice to the State Governments on all matters connected with the rainfall registration, such as selection of sites and installation of raingauges, methods of rainfall observation, inspection of raingauge stations, etc. and (ii) the compilation and issue of consolidated rainfall data for the whole of India (c) rainfall observations are recorded in the country at the observatories and at raingauge stations maintained by the States or their agencies. Raingauge stations whose data are published in the printed Rainfall Tables are classed as "Reporting stations". The number of such stations at present is over 5000. The distribution is shown in Appendix 13.1 - Statement V of the number of stations from each State whose data are received or arranged to be received by the India Meteorological Department at Poona. This number is 4399 and does not include the raingauges maintained by the IMD. Rainfall is recorded daily at all the raingauge stations in the country at 0830 hrs IST and represents the total for the preceding 24 hours and at many departmental observatories, twice or more.

(ii) There is a total network of over 8000 raingauge stations spread all over the country. Out of these, there are about 5000 stations whose records are generally available in published form and/or on punch cards; others are non-reporting stations as stated above.

(iii) Out of the 5561 raingauges inspected, only 2.1 per cent function without any deficiency. Most of the raingauges suffer from some instrumental defect or the other; exposure conditions of raingauges are also not in conformity with the standards laid down by the IMD.

(iv) Implementation of reports of the Inspecting Officers of the IMD has been carried out only in 10.5 per cent cases.

(v) Publication of rainfall data is in arrears anywhere upto 10 years or sometimes even more.

13.10.4 It is clear that the arrangements envisaged in the Rainfall Resolution have not worked and are not working satisfactorily. The quality of data cannot be also said to conform to standards because of instrumental and exposure defects and lack of adequate checking. Printed data are lagging behind and in the data printed, the IMD has to state the following types of lacunae:

(i) The total of daily rainfall values as computed do not tally with the monthly totals printed.

(ii) The heaviest daily rainfall in each month given in the tables is not tallying with the heaviest picked up from daily values due to either shift of line in printing or misprint.

(iii) The monthly totals of rainfall and rainy days shown in the end of Daily Tables do not tally with the corresponding totals given in the Monthly and Annual Tables.

13.10.5 The India Meteorological Department was also asked whether (in view of the unsatisfactory state of rainfall instruments, their exposure and statistics) it was not appropriate that the Department takes up the direct responsibility of all matters pertaining to rainfall organisation. The Department has stated that, though the arrangement between it and the States concerned with regard to the Rainfall Registration in the country has not worked so satisfactorily, it is not practicable to take up the entire job of rainfall registration. However, in order to provide uptodate and accurate printed rainfall data collected according to national standards of instruments and exposure, a scheme entitled 'Reorganisation of Rainfall Registration in India' has been drawn up. The main features of the scheme are:

(i) All raingauges (about 4000) to be procured, inspected and installed departmentally.

(ii) Payment to Rainfall Observer @ Rs.10 p.m. at par with Class V part-time departmental observatories. Payment is to be made by the Department.

(iii) Issue of Monthly Rainfall Bulletin by the Department.

(iv) Publication of monthly and annual rainfall data to be done departmentally.

While noting the action which the India Meteorological Department is proposing to take under its scheme entitled "Reorganisation of Rainfall Registration in India", it is suggested that:

(i) all the existing 8000 raingauges in the country should be brought within the purview of the scheme,

(ii) all of them should belong to the category of "Reporting Raingauges" and

(iii) all the arrears of rainfall data should be printed most expeditiously.

13.10.6 We have given considerable thought to the future of rainfall organisation in the country. Water is a major natural resource and maintenance of proper statistics is essential to meet the requirements of agricultural departments, irrigation departments, etc. The present arrangements which were introduced more than eight decades ago are in bad shape and particularly so during the past two decades or more. The exposure and maintenance of the raingauges are extremely unsatisfactory. Of the existing raingauges, hardly two per cent satisfy the standards. Checking of rainfall data for their accuracy is extremely limited. Hardly ten per cent of the recommendations of inspectors have been implemented. The Director General of observatories is no doubt the technical adviser to States on rainfall registration but his manifold functions leave him little time for this field due to circumstances beyond his control. The problems involved in organising the rainfall registration of the country which already has eight thousand raingauges and which may increase in number rapidly in the future, are considerably complex. The future proposals of the Director General of Observatories outlined above can only meet partially the needs of the situation. We are, however, concentrating here on the requirements for agriculture.

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13.10.7 As a basic policy we recommend that agrometeorological observational organisation including raingauges as required by State Departments of Agriculture should be directly under their respective control. The State Departments of Agriculture should meet the finances needed for the maintenance of the organisation and make provision in their budgets accordingly. In line with this policy, every State should review their requirements immediately and draw up programmes for speedy implementation.

13.10.8 There is increasing demand from many sources for improved and expanded network of raingauges. Daily and short period rainfalls show large differences even at short distances. While States may review the position in this regard taking all aspects into consideration, we recommend as a first step that there should be at least one raingauge in each Block. The number of Blocks is at present about 5100 while the number of reporting State raingauges is 4400. About 700 new raingauges would have to be set up early.

13.10.9 Rainfall recording is done by a variety of officials revenue, police etc. But the current data of the reporting raingauge stations are most needed urgently by the Departments of Agriculture for crop weather seasonal reports, for use of other State and Central departments etc. We, therefore, recommend that the State raingauge network should be placed under the charge of the Director of Agriculture who will take over all the functions and responsibilities of the State Rainfall Registration Authority. We have recommended above that every block area must have at least one raingauge. Also, as Block Development offices will have qualified scientific personnel, they should be in charge of the raingauges in their respective areas regarding observational work, maintenance of equipment, supervision and related work. This would involve shift of all the existing gauges to the Block Development offices which should be done in a phased manner because of the problems involved. These mainly are:

i) The approval for the new sites should be obtained from the Director General of Observatories, who is the technical adviser on Rainfall Registration in the country;

ii) Constructional works at the new site for the erection of raingauges should have to be arranged;

iii) Unsatisfactory equipment should be replaced by standardised new instruments; and

iv) Examination of the applicability of the existing rainfall normals for the new site.

In order to speed up action on all these, coordinated and cooperative action with the Director General of Observatories is essential. It should be emphasised that rainfall record is a compilation of scientific measurements made according to national and international standards and unless taken in the prescribed manner usefulness of such rainfall data will be considerably vitiated.

13.10.10 It has been recommended elsewhere in this report that the State Agricultural Departments will have planning units to look after planning, progress and evaluation of agricultural programmes. This unit will also take over the work of preparing the rainfall data in the form required for publication in State Gazettes as at present. This will enable the State Departments of Agriculture to use the data in their extension and planning work with least delay. The

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daily rainfall data of States should be published after preliminary scrutiny within six months after the month to which they relate to. With the large volume of data coming in, the planning unit should have facilities for getting the basic data punched on cards according to standard format as prescribed by the Agricultural Department after discussions with India Meteorological Department. This arrangement will ensure uniformity, speedier processing, checking for reliability of data and supply.

13.10.11 As the planning unit is to deal with rainfall and meteorological data which will be required by the State Agricultural Departments, we recommend that there should be a qualified Agricultural Meteorologist to handle all this scientific material in this unit. At the Centre, the collection, compilation and analysis of the data should be done in the Directorate of Economics and Statistics. The Directorate should have a person qualified and experienced in Agricultural Meteorology as well as statistics to be in charge of this work so that the meteorological data could be properly analysed and prescribed in a form useful to all the concerned interests.

13.10.12 The Meteorological Department has all the necessary facilities and competence in the matter of checking whether the equipment and data conform to standards etc. They should continue to exercise this responsibility so that all rainfall data recorded in the country will have uniformity in standards. The above proposals would involve considerably increased work to the India Meteorological Department and they should be provided the necessary additional staff so that the existing State rainfall organisation may be placed on firm scientific basis.

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11 SUMMARY OF RECOMMENDATIONS

13.11.1 The main recommendations are summarised below:

Climate

1. Present rainfall normals (1901-50) which are more than two decades old should be revised and published early. Normals of stations computed with records for shorter periods should be reduced to the same period as those with complete records.

(Paragraph 13.2.4)

2. The method of working of district normals should be reviewed. Percentage departures from normal of rainfall for the various meteorological subdivisions should be worked out for all the years from the beginning on a uniform basis and using the latest normals.

(Paragraph 13.2.4)

3. Frequency distributions of daily rainfall should be prepared for all taluk stations and published.

(Paragraph 13.2.7)

4. Weekly totals of rainfall of all stations with data of at least 20 years should be published.

(Paragraph 13.2.8)

5. A good network of snowfall recording stations should be extended. Studies on the contribution of snow to river flow should be undertaken.

(Paragraph 13.2.10)

Glaciology

6. IMD, Geological Survey and other concerned departments should draw up coordinated programmes of

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work in this field with a view to understanding their role in Indian Weather.

(Paragraph 13.2.11)

Rainfall Variability

7. Whenever normals of rainfall of a station or area are computed, they should always be accompanied by their respective standard deviations and values of Coefficient of Variation.

(Paragraph 13.2.13)

8. 'Breaks' in rainfall should be analysed for taluk areas and published for general use.

(Paragraph 13.2.19)

Temperatures

9. Frequencies of daily maximum and minimum temperatures, heat and cold wave spells and duration in hours of temperatures in different ranges should be prepared and published.

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(Paragraph 13.2.20)

10. Reference publications (i) climatological Tables of observatories in India (1931-60) and (ii) Climatological Atlas of India (Abridged) should be reprinted early as copies of these are not readily available.

(Paragraph 13.2.21)

Wind

11. Averages of hourly wind data and frequencies of speeds in different intervals and durations should be published for all the stations for which data are available.

(Paragraph 13.2.24)

12. Complete series of rainfall of all the stations in the country with records of 70 years or more, percenta departures from normal of all the meteorological subdivisions should be published to facilitate detailed studies of trends and periodicity in Indian rainfall.

(Paragraph 13.2.26)

Climatic change

13. The problems concerning climatic change and prediction should be taken up as a research project by the Indian Institute of Tropical Meteorology, Poona in cooperation with India Meteorological Department and ICAR etc.

(Paragraph 13.2.28)

Agrometeorology

14. ICAR should examine the feasibility of inclusion in their future programmes of research biochemical studies for a fuller understanding of crop weather relationships.

(Paragraph 13.3.2)

15. There is urgent need to go in for phytotrons at all the agricultural universities to have clearer ideas on crop weather relationships under controlled conditions.

(Paragraph 13.3.4)

16. Each one of the rainfall zones into which the country has been divided (vide Chapter 14) should have at least one fully equipped agromet observatory.

(Paragraph 13.3.5)

17. Every taluk should have at least one soil moisture measuring station. The total for the country would be about 3000 and this network should be built up by the State Agricultural Departments during the next few decades. They should also arrange for the publication of these data.

(Paragraph 13.3.6)

18. Studies of evapotranspiration under varying conditions of soil moisture in different soils and using as many plant species as possible are urgent and this work should be started at all the agricultural universities, the central institutes of ICAR and the Forest Research Institute, Dehra Dun. Based on the results of these studies, a suitable network of stations, one at least in each district, for actual observational measurements should be started.

(Paragraph 13.3.8)

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19. The network of stations recording phenological observations should be expanded so that there is at least one station in each taluk. The selection has to be of nature-grown plants as far as possible.

(Paragraph 13.3.9)

20. ICAR should organise a joint meeting of plant pathologists, entomologists and agricultural meteorologists for organising a unified approach to the study of problems of pests and diseases. These will not only include the relationship under field conditions between weather and pests and diseases but also steps for starting a surveillance service based on meteorological

factors which should be helpful in forecasting and controlling the epidemics.

(Paragraph 13.3.10)

21. Meteorological observatories in adequate numbers should be set up in orchards, plantations and forests.

(Paragraph 13.3.12)

22. India Meteorological Department in consultation with Forest Research Institute, Dehra Dun and State Forest Departments should draw up a long term research programme in forest meteorology.

(Paragraph 13.3.13)

23. All institutions and organisations dealing with animal research and dairy, piggery and poultry should arrange for meteorological observations needed for their work and conduct micro-climatic studies within paddocks and barns.

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(Paragraph 13.3.15)

24. Research studies should be undertaken with a view to forecasting animal diseases.

(Paragraph 13.3.16)

Droughts

25. Comprehensive and systematic studies of all past droughts by dynamic and synoptic climatological methods should be undertaken as a joint project by the India Meteorological Department and the Indian Institute of Tropical Meteorology, Poona, for developing techniques for forecasting them.

(Paragraph 13.4.8)

Crop Weather Calendars

26. Existing crop weather calendars should be brought up-to-date. Separate calendars should be prepared for early, normal and late sowing varieties of each crop in different areas of the country. They should also be prepared for crops like soyabean, cow-pea, safflower, sunflower etc.

Weather Bulletins (Paragraph 13.5.3)

27. Weather bulletins for farmers should include advice on agricultural operations and should be prepared daily after joint discussions between forecasting officer and agricultural officer deputed by local agricultural department to make them purposeful. In the light of Karnataka and Tamil Nadu experience this arrangement of joint daily discussions in preparation of operational weather bulletins should be compulsorily extended to all States. The trial SITE programme of weather broadcasts for farmers issued after joint discussions of representatives from ICAR, Agricultural Meteorologist and the weather forecaster should become a regular feature.

(Paragraph 13.5.4)

28. IMD should evaluate each year the performance of weather bulletins for farmers and discuss at conferences of agriculturists at State level. ICAR should consider convening of such periodical conferences for evaluating weather service to farmers and for their improvement.

(Paragraph 13.5.5.)

29. Every State should issue a weekly crop weather bulletin containing description of week's weather and crops in the State and outlook for a week ahead. The responsibility for the compilation and issue should be that of the Directorate of Economics and Statistics with cooperation from the local Meteorologist, the Director of Agriculture of the State and a representative from local agricultural university.

(Paragraph 13.5.7)

Extended Range Forecasting

30. Research into various aspects of 'Extended Range Forecasting' should be given priority and work distributed among the IMD, Indian Institute of Tropical Meteorology, Poona and other interested institutions. An advisory working group may be set up with the Director General of Observatories as Chairman and membership from IMD, ICAR and State Agricultural Departments to periodically assess and review the speedy implementation of programmes of work.

(Paragraph 13.6.7)

Crop Weather Relationships

31 (i) Crop weather studies in progress in the IMD should be intensified and formulae developed on a districtwise basis.

(ii) Detailed data on acreage, yield etc. according to varieties, irrigation, cultural practices etc. are essential for crop weather studies and these should be compiled in standard format by Directorate of

Economics and Statistics. Formulae for forecasts of crop agreage should be developed using climatological factors.

(Paragraphs 13.7.9 and
13.7.10)

Weather Modification

32. The research and operational aspects of the present organisation for weather modification in the India Meteorological Department and Indian Institute of Tropical Meteorology should be strengthened to conduct further trials and experiments to arrive at dependable conclusions.

(Paragraph 13.8.8)

Research Education and Training

33. Work in the field of Mathematical Simulation Modelling should be reviewed and attempts made with data available in India. IMD in consultation with ICAR should work out a joint programme of study using this approach.

(Paragraph 13.9.2)

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34. Production functions for crop yields should be worked out using techniques of analysis developed in the Indian Statistical Institute and in the paper on irrigation evaluation under monsoon rainfall conditions.

(Paragraphs 13.9.3 and
13.9.4)

35. The present position regarding agroclimatological atlas should be reviewed and as soon as feasible, a detailed and comprehensive atlas should be prepared.

(Paragraph 13.9.5)

36. Inservice training of staff for manning various types of Agromet observatories should be arranged

by the State agricultural organisations in cooperation with IMD.

(Paragraph 13.9.7)

37. Agricultural Meteorologists should be deputed to meetings of the Commission of Agricultural Meteorology of World Meteorological Organisation.

(Paragraph 13.9.8)

Observational Organisation

38. As a policy, the observational organisation needed by State Departments of Agriculture etc. should be controlled and maintained by them. They should provide all the finances needed for the purpose. Every State should immediately review their observational requirements and the organisation needed by them for necessary action.

(Paragraph 13.10.7)

39. Every Block should have at least one raingauge and they should be located in Block Development Office.

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(Paragraph 13.10.8)

40. Rainfall Organisation in the States which is primarily needed by the State Agricultural Departments should be placed under their direct control; they will examine the present locations etc. of raingauges and take action to shift them to block offices in consultation with and cooperation of the Director General of Observatories who will continue to be technical adviser on all matters concerning meteorological observations.

(Paragraph 13.10.9)

41. Departments of Agriculture will have a planning unit for dealing with planning, progress and evaluation of agricultural programmes. Each unit must have a qualified Agricultural Meteorologist who should look after all matters pertaining to meteorology including the rainfall organisation. He will arrange for the collection, scrutiny, checking, processing and publication of the data and for supply of data to all concerned. At the centre, these items of work should be handled by the Directorate of Economics & Statistics. As these form basic data for analysis they should also be punched in prescribed formats in consultation with India Meteorological Department.

(Paragraphs 13.10.10 and 13.10.11)

42. The proposals regarding reorganisation of State rainfall organisation will involve considerably increased work to the India Meteorological Department and they should be provided with additional staff for the purpose.

(Paragraph 13.10.12)

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APPENDIX 13.1

(Paragraph 13.2.1)

Statement I Average Latitudinal position of Depressions Crossing Different Longitudes from 92 to 75°E during July and August based on data of 80 years from 1891 to 1970.

Longitude °E	number which crossed different longitude	average latitudinal position	standard deviation
92		19.31	2.06
91	13	20.50	1.75
90	51	20.70	1.45
89	112	20.90	1.36
88	180	21.09	1.27
87	225	21.25	1.34
86	218	21.59	1.38
85	208	21.94	1.46
84	196	22.29	1.48
83	185	22.66	1.31
82	169	23.03	1.30
81	153	23.36	1.30
80	129	23.61	1.33
79	109	23.89	1.39
78	87	24.19	1.51
77	66	24.36	1.42
76	59	24.68	1.46
75	49	24.77	1.44

Source:- From an unpublished report
by K. Suryanarayana,
Indian Institute of Tropical Meteorology

APPENDIX 13.1 (contd)

(Paragrah 13.2.3)

Statement II Normals of Rainfall (Cm) for Meteorological Subdivisions of the Country

Meteorological Sub-divisions	Annual	Season Jan-Feb Jan	Feb	ST	P	Season Mar-May Mar	Apr	May	ST	P	Season June-Sept Jun	Jul	Aug	Sep	ST	P	Season Oct-Dec Oct	Nov	Dec	ST	P
Bay Island	300	5	3	8	3	3	7	35	45	15	53	38	40	47	178	59	29	23	17	69	23
Assam (including Manipur and Tripura)	252	2	4	6	2	8	21	34	63	25	48	45	40	32	165	65	14	3	1	18	7
Sub-Himalayan West Bengal	311	1	2	3	1	4	12	33	49	16	[illegible]	68	57	[illegible]	242	78	16	1	L	17	5
Gangetic West Bengal	144	1	3	4	3	3	4	11	18	12	24	32	32	21	109	76	11	2	L	13	9
Orissa	149	1	3	4	3	2	4	7	13	9	21	35	34	24	114	76	13	4	1	18	12
Bihar Plateau	137	2	3	5	4	2	2	5	9	7	20	36	35	22	113	82	8	2	L	10	7
Bihar Plains	120	1	2	3	2	1	2	5	8	7	17	31	31	23	102	85	6	1	L	7	6
Uttar Pradesh (East)	102	2	2	4	4	1	1	1	3	3	10	30	30	19	89	87	4	1	1	6	6
Uttar Pradesh (West)	96	2	3	5	5	1	1	1	3	3	9	29	29	17	84	88	3	L	1	4	4
Punjab including Delhi	62	3	3	6	10	2	1	1	4	6	5	18	17	10	50	81	1	L	1	2	3
Himachal Pradesh	Not available																				
Jammu and Kashmir	102	10	10	20	20	11	8	5	24	24	6	17	17	8	48	47	3	2	5	10	10
Rajasthan (East)	69	1	1	2	3	L	L	1		1	7	24	23	11	65	94	1	L	L	1	1
Rajasthan (West)	31	1	1	2	6	L	L	1	1	3	3	10	11	4	28	90	L	L	L	L	-
Madhya Pradesh (West)	105	1	1	2	2	1	L	1	2	2	13	35	29	18	95	90	3	2	1	6	6

	Meteorological Sub-divisions	Annual	Season Jan-Feb				Season Mar-May					Season June-Sept						Season Oct-Dec				
			Jan	Feb	ST	P	Mar	Apr	May	ST	P	Jun	Jul	Aug	Sep	ST	P	Oct	Nov	Dec	ST	P
16	Madhya Pradesh (East)	143	2	3	5	3	2	2	2	6 0	4	19	43	39	22	123	86	6	2	1	~~0~~ 9	[illegible]
17	Gujarat Region	97	L	L	L	-	L	L	1	1	1	13	40	24	16	93	96	2	1	L	3	3
18	Saurashtra and Kutch	48	L	L	L	-	L	L	1	1	2	7	21	10	7	45	94	2	L	L	2	4
19	Konkan	287	L	L	L	-	L	1	3	4	1	62	108	63	37	270	94	10	3	L	13	5
20	Madhya Maharashtra	92	1	L	1	1	L	1	2	3	3	15	28	18	16	77	84	7	3	1	11	1
21	Marathawada	88	1	1	2	3	1	1	2	4	5	14	17	14	20	65	81	5	3	1	9	1
22	Vidarbha	109	1	2	3	3	1	1	1	3	3	17	34	26	18	95	87	5	2	1	8	7
23	Coastal Andhra Pradesh	100	1	1	2	2	1	2	5	8	8	10	15	15	17	57	57	19	12	2	33	33
24	Telangana	91	1	2	3	3	1	2	2	5	5	13	24	19	19	75	82	6	2	L	8	9
25	Rayalaseema	68	1	1	2	3	1	2	5	8	12	6	8	10	13	37	54	11	8	2	21	31
26	TamilNadu	102	4	2	6	6	2	5	7	14	14	6	7	10	11	34	33	19	20	9	48	47
27	Coastal ~~Mysore~~ Karnataka	326	L	L	L	-	1	3	11	15	5	84	110	63	28	285	87	18	7	1	26	8
28	Interior ~~Mysore~~(N) Karnataka	69	L	L	L	-	1	3	5	9	13	9	13	10	13	45	65	10	4	1	15	22
29	Interior Mysore(S) Karnataka	124	L	1	1	1	1	5	10	16	13	18	31	21	14	84	68	15	7	1	23	19
30	Kerala	301	2	2	4	1	5	11	25	41	14	67	68	42	24	201	67	31	19	5	55	18
31	Arabian Sea Island	155	3	1	4	3	1	4	15	20	13	34	28	21	15	98	63	16	11	6	33	21

ST = Seasonal Total L = Less than 1 cm P = Percentage

APPENDIX 13.1 (contd)

(Paragraph 13.2.3)

Statement III - Normals of Rainy Days for Meteorological Sub-divisions of the Country.

Sl. No.	Meteorological Sub-divisions	Annual	Season Jan-Feb Jan	Feb	ST	P	Season Mar-May Mar	Apr	May	ST	P	Season June-Sept Jun	Jul	Aug	Sep	ST	P	Season Oct -Dec Oct	Nov	Dec	ST	P
1	Bay Islands	141	2	2	4	3	2	5	15	22	16	21	19	20	20	80	57	15	12	7	34	2
2	Assam (including Manipur & Tripura)	114	2	3	5	4	5	11	15	31	27	18	19	17	14	68	60	7	2	0.8	10	9
3	Sub-Himalayan West Bengal	99	0.8	2	3	3	2	6	13	21	21	18	19	18	15	70	70	6	0.9	0.3	7	7
4	Gangetic West Bengal	72	1	2	3	4	2	3	6	10	14	11	15	15	11	52	74	5	1	0.2	6	[illegible]
5	Orissa	72	0.9	2	3	4	1	3	4	8	11	10	16	15	12	53	74	6	2	0.4	8	
6	Bihar Plateau	71	2	2	4	6	2	2	3	7	10	10	17	17	11	55	77	4	0.9	0.4	5	
7	Bihar Plains	54	1	2	3	5	0.9	1	3	5	9	7	13	13	9	42	80	3	0.5	0.3	4	
8	Uttar Pradesh (East)	48	1	2	3	6	0.8	0.6	1	2	6	5	13	13	8	39	81	2	0.4	0.5	3	
9	Uttar Pradesh (West)	44	2	2	4	9	1	0.8	1	3	7	4	12	12	7	35	79	1	0.3	0.8	2	
10	Punjab (including Delhi	32	2	2	4	13	2	1	1	4	13	3	8	7	4	22	69	0.6	0.3	1	2	
11	Himachal Pradesh	73	6	4	10	13	6	4	4	14	19	6	15	14	8	43	58	3	0.7	3	7	
12	Jammu and Kashmir	54	5	5	10	20	6	5	4	15	28	4	7	8	4	23	42	2	1	3	6	
13	Rajasthan (East)	34	0.8	0.6	1	3	0.5	0.4	0.8	2	6	4	11	10	5	30	88	0.7	0.3	0.4	1	
14	Rajasthan (West)	17	0.5	0.6	1	6	0.4	0.3	0.7	1	6	2	5	5	2	14	82	0.3	0.1	0.2	0.6	
15	Madhya Pradesh (West)	49	1	0.9	2	4	0.7	0.4	0.8	2	4	7	14	13	8	42	85	2	0.9	0.6	3	
16	Madhya Pradesh (East)	67	1	2	3	5	1	1	1	3	6	9	18	17	11	55	81	3	0.9	0.5	.4	

ST = Seasonal Total P = Percentage

S.No.	Meteorological Sub-Divisions	Annual	Season Jan-Feb Jan	Feb	ST	P	Season Mar-May Mar	Apr	May	ST	P	Season June-Sept Jun	Jul	Aug	Sep	ST	P	Season Oct-Dec Oct	Nov	Dec	ST	P
17	Gujarat Region	43	0.2	0.2	0.4	1	0.1	0.2	0.4	0.7	2	5	15	12	7	39	92	1	0.5	0.1	2	4
18	Saurashtra and Kutch	23	0.2	0.2	0.4	2	0.1	0.1	0.4	0.6	3	3	9	6	3	21	92	0.7	0.2	0.1	1	4
19	Konkan	93	0.2	0.1	0.3	0	0.1	0.4	1	1	2	17	27	24	16	84	91	5	1	0.3	6	7
20	Madhya Maharashtra	49	0.4	0.2	0.6	1	0.3	0.9	2	3	6	8	13	10	9	40	79	4	2	0.5	7	13
21	Marathwada	45	0.5	0.5	1	2	0.6	0.9	1	3	6	8	11	9	9	37	81	3	2	0.5	5	11
22	Vidarbha	55	0.9	1	2	4	1	0.9	1	3	6	9	15	12	9	45	83	3	1	0.6	5	8
23	Coastal Andhra Pradesh	53	0.6	0.8	1	3	0.7	2	3	6	10	6	10	9	9	34	63	7	4	1	12	24
24	Telangana	54	0.4	1	1	3	0.9	2	2	5	8	8	14	11	10	43	79	4	2	0.3	6	10
25	Rayalaseema	41	0.6	0.4	1	2	0.4	1	3	4	12	4	6	6	7	23	57	6	4	1	11	29
26	Tamil Nadu	53	2	1	3	5	1	3	4	8	16	4	4	6	6	20	37	9	9	4	22	43
27	Coastal Karnataka	112	0.2	0.1	0.3	0	0.4	2	5	7	7	23	28	25	16	92	81	9	4	0.8	14	12
28	Interior Karnataka (North)	47	0.2	0.2	0.4	1	0.6	2	4	7	14	7	10	8	8	33	68	6	2	0.6	9	19
29	Interior Karnataka (South)	67	0.4	0.4	0.8	1	0.7	3	6	10	15	9	13	11	9	42	63	9	4	1	14	20
30	Kerala	126	1	1	2	2	3	7	10	20	15	23	24	19	13	79	62	14	9	3	26	21
31	Arabian Sea Islands	87	2	0.8	3	3	0.9	2	7	10	11	17	15	12	10	54	63	9	7	3	19	22

ST = Seasonal Total P = Percentage

APPENDIX 13.1 (contd)

(Paragraph 13.2.3)

Statement IV - Coefficient of Variation (%) of Monthly Seasonal and Annual Rainfall for 31 Meteorological Sub-divisions of India

Sub-division	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual	Jan-Feb	Mar-May	June-Sept	June-Oct	Oct - Dec
1 North Assam	75	56	59	34	30	17	18	21	22	41	90	110	8	38	22	8	8	37
2 South Assam	134	73	64	37	35	19	21	20	22	46	107	151	9	57	23	10	9	38
3 Sub-Himalayan West Bengal	118	85	86	58	27	24	27	28	27	67	184	205	12	63	26	13	12	62
4 Gangetic /West Bengal	117	111	108	73	44	41	28	23	26	69	149	200	13	86	36	14	15	62
5 Orissa	121	104	106	77	55	42	26	24	22	65	135	220	11	81	42	12	13	53
6 Bihar Plateau	112	92	108	83	60	46	25	18	29	83	168	203	11	70	45	12	12	72
7 Bihar Plains	106	90	120	103	55	49	27	26	35	91	196	241	14	66	43	16	15	81
8 Uttar Pradesh (East)	99	107	140	166	86	59	36	25	43	128	230	146	18	70	72	20	20	104
9 Uttar Pradesh (West)	84	89	99	112	75	68	31	33	61	147	203	121	19	56	59	22	23	98
10 Haryana	91	97	111	163	127	82	41	51	87	193	251	131	28	62	76	31	32	114
11 Punjab	79	86	92	107	86	73	38	43	104	208	200	102	26	52	54	32	33	91
12 Himachal Pradesh	68	64	71	64	58	61	26	31	67	122	166	88	16	43	39	21	22	67
13 Jammu and Kashmir	57	59	50	48	53	56	33	82	82	103	139	75	16	38	28	26	26	62
14 Rajasthan West	130	162	174	166	146	81	54	74	107	n.a.	220	184	42	105	99	43	n.a	65
15 Rajasthan East	101	124	168	221	135	78	40	50	72	n.a.	170	152	28	81	99	30	45	43

Sub-division	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual	Jan-Feb	Mar-May	June-Sept	June-Oct	Oct Dec
16 **Madhya Pradesh (West)**	114	110	131	151	130	53	29	35	50	114	172	153	18	76	78	18	19	83
17 **Madhya Pradesh (East)**	127	89	120	125	102	47	23	25	34	85	137	169	13	75	68	13	13	68
18 Gujarat	262	176	275	385	225	71	46	59	73	190	194	229	29	163	170	29	29	14
19 Saurashtra and Kutch	195	193	336	469	258	93	53	70	96	226	223	286	35	134	196	36	36	17
20 Konkan	236	295	187	246	209	36	29	36	47	100	147	240	16	188	174	16	17	86
21 Madhya /Maharashtra	184	188	175	114	102	37	28	36	39	70	125	179	18	145	67	17	18	59
22 Marathwada	199	165	176	140	147	46	41	48	46	87	151	183	25	119	88	25	26	70
23 Vidarbha	143	120	124	155	129	46	29	33	43	103	152	181	20	86	78	19	20	73
24 Coastal Andhra Pradesh	135	166	180	90	71	42	29	28	32	50	69	131	16	106	54	18	18	36
25 Telengana	180	139	152	97	85	41	29	30	42	72	115	212	20	97	58	20	21	64
26 **Rayalaseema**	152	190	205	92	68	35	78	59	37	49	72	141	21	109	49	28	26	40
27 Tamil Nadu	109	117	89	57	47	27	38	37	35	37	48	82	14	77	32	18	14	28
28 Coastal Karnataka	188	321	136	87	112	22	27	35	51	45	80	177	12	162	83	14	13	39
29 Interior Karnataka (North)	187	189	134	68	52	25	32	51	36	51	117	206	18	127	38	19	18	54
30 Iterior Karnataka south	139	186	104	53	40	30	30	38	38	43	76	141	15	107	29	19	16	37
31 Kerala	111	107	66	39	67	26	30	44	47	29	44	87	12	69	40	18	15	24

* Based on data for 1901-1950.

APPENDIX 13.1 (contd)

(Paragraph 13.2.4)

Statement V Number of Raingauges - Statewise - having published Normals and Number of Reporting Raingauges for which Rainfall Data are received or arranged to be received by IMD at Poona

State/Union territory	no. of raingauges	
	*having published normals	reporting
1. Assam	86	114
2. Arunachal Pradesh	3	40
3. Andhra Pradesh	226	551
4. Bihar	230	449
5. Gujarat	110	239
6. Haryana(including Delhi)	48	76
7. Himachal Pradesh	17	73
8. Jammu and Kashmir	36	76
9. Karnataka	160	391
10. Kerala	78	122
11. Madhya Pradesh	254	332
12. Maharashtra	225	285
13. Manipur	4	16
14. Meghalaya	7	10
15. Mizoram	8	7
16. Nagaland	6	-
17. Orissa	110	258
18. Punjab	45	105
19. Rajasthan	194	416
20. Tamil Nadu	229	342
21. Tripura	9	14
22. Uttar Pradesh	274	331
23. West Bengal	129	142
total	2488	4399

Source:- Observational Organisation as on January 1, 1975
India Meteorological Department, New Delhi.

* Published in Memoirs of the India Meteorological Department Vol XXXI, Part III, 1962.

Reporting station means rainfall data of which are received or arranged to be received at Poona.

APPENDIX 13.1 (contd)

(Paragraph 13.2)

Statement VI : Intercorrelation Coefficients (X 10)

	Apr	May	Jun	Jul	Aug	Sep	Monsoon Season	Annual
				EAST UTTAR PRADESH				
April	100	06	23	06	-21	-16	-05	-19
May		100	12	06	-17	-14	-07	-14
June			100	06	12	-11	38	26
July				100	-10	00	60	53
August					100	15	45	48
September						100	53	33
Monsoon Season							100	76
Annual								100
				MADHYA MAHARASHTRA				
April	100	-26	-07	03	25	02	08	-03
May		100	-01	-21	-13	17	-27	01
June			100	-14	-08	-06	34	27
July				100	07	01	54	16
August					100	15	56	02
September						100	57	06
Monsoon Season							100	25
Annual								100
				TAMIL NADU				
April	100	-04	17	-08	03	-07	01	15
May		100	10	-14	-13	08	01	37
June			100	08	-01	29	37	34
July				100	29	05	61	-17
August					100	-19	46	08
September						100	58	24
Monsoon Season							100	17
Annual								100

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APPENDIX 13.I (Contd.) (Paragraph 13.2.14)

Statement VII Intercorrelations between Sub-divisions June to September

	North Assam	South Assam	Sub-Himalayan West Bengal	Gangetic West Bengal	Orissa	Bihar Plateau	Bihar Plains	East Uttar Pradesh	West Uttar Pradesh	Haryana	Punjab	Himachal Pradesh	Jammu and Kashmir	West Rajasthan	East Rajasthan
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2 North Assam	1.00	.51	.35	-.44	-.37	-.22	.07	-.06	-.15	-.22	-.25	-.27	-.20	-.20	-.20
3 South Assam		1.00	.05	-.20	-.31	-.25	.08	-.14	-.15	-.29	-.16	-.30	-.29	-.21	-.23
4 Sub-Himalayan West Bengal			1.00	-.08	-.15	.08	.54	.10	.04	-.16	-.20	-.14	-.03	-.12	-.09
5 Gangetic West Bengal				1.00	.27	.61	.32	-.07	.03	.22	.16	.13	-.12	.15	.10
6 Orissa					1.00	-.28	-.01	.04	.18	.31	.29	.33	.47	.29	.11
7 Bihar Plateau						1.00	.44	.20	.25	.22	.10	.10	-.10	.04	.05
8 Bihar Plains							1.00	.44	.21	-.04	-.14	-.06	-.07	-.29	-.13
9 East Uttar Pradesh								1.00	.59	.20	.06	.31	.12	-.02	.28
10 West Uttar Pradesh									1.00	.54	.40	.57	.13	.23	.43
11 Haryana										1.00	.72	.61	.15	.62	.48
12 Punjab											1.00	.63	.29	.68	.45
13 Himachal Pradesh												1.00	.19	.45	.50
14 Jammu and Kashmir													1.00	.06	-.06
15 West Rajasthan														1.00	.53
16 East Rajasthan															1.00
17 West Madhya Pradesh															
18 East Madhya Pradesh															
19 Gujarat(Region)															
20 Saurashtra and Kutch															
21 Konkan															
22 Madhya Maharashtra															
23 Marathwada															
24 Vidarbha															
25 Coastal Andhra Pradesh															
26 Telangana															
27 Rayalaseema															
28 Tamil Nadu															
29 Coastal Karnataka															
30 Interior Karnataka North															
31 Interior Karnataka South															
32 Kerala															

Madhya Pradesh	East Madhya Pradesh	Gujarat (Region)	Saurashtra and Kutch	Konkan	Madhya Maharashtra	Marathwada	Vidarbha	Coastal Andhra Prad	Telangana	Rayalaseema	Tamil Nadu	Coastal Karnataka	Interior Karnataka North	Interior Karnataka South	Kerala	
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
-.02	-.21	-.20	.02	-.23	-.22	-.06	.02	.16	-.03	.15	-.09	-.30	-.05	-.22	-.22	2
-.10	-.28	-.17	.03	-.33	-.21	-.03	.02	.05	.01	.13	-.02	-.36	-.15	-.30	-.28	3
-.27	-.18	-.05	.23	-.20	-.14	-.02	.14	.17	-.11	.28	.10	-.23	-.06	.00	-.03	4
-.11	.16	.21	-.04	.10	.06	-.01	.13	-.26	-.16	-.17	-.01	-.05	-.06	-.12	-.03	5
.38	.24	.22	-.03	.22	.24	.05	-.03	-.01	.18	-.12	.18	.20	-.05	-.12	-.15	6
.09	.21	.04	-.12	-.05	-.13	-.21	.05	-.44	-.37	-.27	-.15	-.04	-.35	-.08	.10	7
-.17	-.12	-.17	.17	-.25	-.20	.04	.04	.09	-.12	.23	.19	-.33	-.25	-.05	-.07	8
.33	.17	-.20	.20	.14	.11	.21	.08	.29	.37	.28	.27	.04	-.14	.07	.08	9
.37	.49	.15	-.01	.27	.18	.25	.22	.29	.28	.29	.32	.23	-.09	.30	.21	10
.38	.77	.46	.00	.50	.38	.40	.35	.29	.34	.15	.21	.40	.18	.37	.22	11
.25	.73	.53	.05	.48	.43	.46	-.05	.42	.51	.19	.27	.52	.31	.37	.16	12
.44	.62	.46	.06	.43	.42	.43	.04	.35	.43	.17	.29	.32	.22	.32	.11	13
.32	.32	-.03	-.02	-.07	-.04	.02	.00	.14	.16	.02	-.15	.11	-.04	-.02	-.20	14
.28	.80	.66	.14	.54	.48	.39	.11	.39	.46	.25	.28	.40	.30	.30	.07	15
.44	.63	.38	.16	.55	.49	.54	.02	.32	.38	.29	.35	.31	.26	.32	.13	16
1.00	.32	.09	.10	.35	.24	.23	.13	.14	.34	.11	-.04	.20	.01	.08	-.11	17
	1.00	.54	.08	.54	.42	.47	.04	.32	.41	.23	.34	.49	.25	.40	.26	18
		1.00	.28	.56	.57	.19	.27	.32	.28	.29	.20	.29	.25	.23	.00	19
			1.00	.27	.36	.27	.12	.37	.30	.45	.23	.06	.28	.11	-.12	20
				1.00	.77	.60	.17	.38	.56	.29	.20	.58	.52	.29	.14	21
					1.00	.62	.06	.47	.55	.42	.37	.50	.66	.41	.13	22
						1.00	-.08	.61	.70	.51	.47	.33	.59	.33	.01	23
							1.00	.08	.00	.32	.05	-.03	-.10	.10	.01	24
								1.00	.74	.79	.59	.23	.57	.39	.02	25
									1.00	.51	.35	.46	.53	.27	.02	26
										1.00	.64	.00	.37	.30	-.10	27
											1.00	.15	.33	.53	.37	28
												1.00	.44	.51	.62	29
													1.00	.55	.25	30
														1.00	.71	31
															1.00	32

APPENDIX 13.1 (contd)

(Paragraph 13.2.1

Statement VIII Percentage Departure (from normal) of rainfall in the Meteorological Sub-Divisions of India during twelve break periods

Meteorological Sub-Division	24-29 August 1951	18-29 July 1954	21-25 August 1954	22-29 July 1955	23-26 August 1956	18-22 August 1962	17-21 July 1963	28 July - 3 Aug. 1964	4-15 August 1965	2-11 July 1966	23-27 August 1966	7-10 July 1967	Mean Dep.
North Assam	+ 81	+ 65	+ 62	+ 83	+ 60	+ 166	+ 9	+ 104	+ 27	+ 22	+ 98	+ 105	+ 73
South Assam	+ 308	+ 150	+ 246	+ 118	- 15	+ 166	- 44	+ 127	+ 40	- 1	+ 211	+ 170	+ 123
Sub-Himalayan West Bengal	+ 97	+ 76	+ 3	+ 123	+ 61	+ 125	+ 47	+ 109	+ 64	+ 28	+ 265	+ 230	+ 102
Gangetic West Bengal	- 45	- 44	- 47	+ 19	+ 28	+ 19	- 2	+ 9	- 40	- 51	- 43	- 11	- 17
Orissa	- 54	- 70	- 65	- 63	- 5	- 36	- 47	- 51	- 37	- 74	- 73	- 31	- 51
Bihar Plateau	- 75	- 49	- 54	- 42	- 5	+ 15	- 37	- 54	- 69	- 73	- 40	- 49	- 44
Bihar Plains	- 15	+ 54	- 14	+ 28	+ 126	+ 211	+ 35	+ 21	- 33	- 52	+ 35	+ 49	+ 37
East Uttar Pradesh	- 65	+ 33	- 67	- 28	0	+ 246	- 32	+ 28	- 85	- 89	- 55	- 38	- 13
West Uttar Pradesh:													
Plains	- 88	+ 9	- 85	- 93	+ 53	- 5	- 43	- 10	- 85	- 97	- 54	- 37	- 45
Hills	- 60	+ 23	+ 87	- 74	- 31	+ 52	+ 2	- 46	- 61	- 46	+ 27	+ 105	- 2
Punjab	- 75	+ 5	- 98	- 91	+ 35	+ 169	- 81	- 1	- 63	- 63	- 98	+ 29	- 28
Himachal Pradesh	+ 1	- 17	+ 22	- 56	- 36	- 31	+ 117	- 57	- 79	- 78	- 63	- 32	- 26
Jammu and Kashmir	- 26	- 80	- 98	- 75	- 33	- 35	- 13	- 28	- 56	- 32	- 92	- 95	- 55
West Rajasthan	- 100	- 55	- 100	- 100	- 97	0	- 90	- 92	- 99	- 50	- 100	- 77	- 80
East Rajasthan	- 100	- 77	- 90	- 98	- 85	- 46	- 66	- 81	- 99	- 92	- 100	- 75	- 84

Meteorological Sub-Division	24-29 August 1951	18-29 July 1954	21-25 August 1954	22-29 July 1955	23-26 August 1956	18-22 August 1962	17-21 July 1963	28 July -3 Aug. 1964	4-15 August 1965	2-11 July 1966	23-27 August 1966	7-10 July 1967	Mean Dep.
West Madhya Pradesh	- 95	- 56	- 91	- 59	- 92	- 63	- 67	- 81	- 80	- 92	- 92	- 88	- 80
East Madhya Pradesh	- 89	- 39	- 41	- 39	- 80	- 51	- 39	- 75	- 73	- 91	- 76	- 74	- 64
Vidarbha	- 55	- 51	- 89	- 51	- 94	- 62	- 95	- 69	- 70	- 91	- 98	- 96	- 77
Gujarat Region	- 95	- 57	- 84	- 81	- 44	- 34	- 77	- 65	- 97	- 92	- 100	- 91	- 76
Saurashtra and Kutch	- 99	- 77	- 94	- 79	- 97	- 77	- 80	- 76	- 96	- 82	- 100	- 69	- 85
Konkan	- 65	- 18	- 31	+ 108	- 76	- 58	- 54	+ 3	- 70	- 87	- 73	- 56	- 40
Madhya Maharashtra	- 65	- 41	- 67	- 53	- 56	- 53	- 79	- 44	- 55	- 56	- 70	- 68	- 59
Marathwada	- 100	+ 4	- 99	+ 55	- 86	+ 11	- 89	+ 1	+ 13	- 43	- 100	- 100	- 44
Coastal Andhra Pradesh	+ 3	+ 31	+ 26	- 3	+ 11	- 14	- 5	- 46	- 57	- 65	- 6	- 90	- 18
Telangana	- 47	- 7	- 93	- 55	- 83	- 36	- 62	- 43	- 79	- 88	- 94	- 97	- 65
Rayalaseema	+ 13	+ 357	- 69	+ 13	- 77	+ 13	+ 126	+ 243	+ 85	+ 64	- 95	- 77	+ 50
Tamil Nadu	+ 59	+ 123	+ 40	- 44	+ 138	+ 94	+ 71	+ 303	+ 128	+ 121	+ 108	- 11	+ 94
Coastal Karnataka	- 88	+ 19	- 91	+ 74	- 87	+ 54	- 61	+ 78	- 72	- 60	- 84	- 12	- 27
Interior Karnataka North	- 53	+ 42	- 51	- 13	- 85	- 21	- 88	+ 140	- 15	- 44	- 100	- 73	- 30
Interior Karnataka South	- 66	- 9	- 41	- 50	- 97	- 63	- 66	+ 100	- 1	- 25	- 95	- 55	- 39
Kerala	+ 18	- 29	- 95	- 17	- 88	- 81	- 76	+ 44	- 24	- 81	- 71	- 44	- 41

APPENDIX 13.1 (contd)

(Paragraph 13.2.18)

Statement IX Spatial Distribution of Rainfall during Breaks (expressed as percentage)

Meteorological Sub-Division		Category of Distribution				
		Wide-spread	Fairly Wide-spread	Scattered	Isolated	Dry
North Assam		55	28	13	4	-
South Assam		62	24	12	2	-
Sub-Himalayan West Bengal		87	9	3	1	-
Gangetic West Bengal		13	17	22	42	6
Orissa		1	19	31	43	6
Bihar Plateau		17	11	36	24	12
Bihar Plains		27	19	25	18	11
East Uttar Pradesh		9	17	24	30	20
West Uttar Pradesh:	Hill	17	28	35	-	20
	Plain	10	10	19	38	23
Punjab		4	7	17	27	45
Himachal Pradesh		29	18	15	19	19
Jammu and Kashmir		-	5	11	22	62
West Rajasthan		-	-	8	7	85
East Rajasthan		1	1	12	26	60
West Madhya Pradesh		1	5	21	50	23
East Madhya Pradesh		6	15	39	26	14
Vidarbha		4	6	10	42	38
Gujarat Region		-	2	34	16	48
Saurashtra and Kutch		-	-	8	35	57
Konkan		41	17	27	7	8
Madhya Maharashtra		4	6	28	56	6
Marathwada		6	-	30	-	64
Coastal Andhra Pradesh		-	9	30	42	19
Telangana		2	10	25	21	42
Rayalaseema		4	13	16	25	42
Tamil Nadu		4	7	45	36	8
Coastal Karnataka		54	12	16	-	18
North Interior Karnataka		5	4	28	37	26
South Interior Karnataka		6	19	31	21	23
Kerala		25	16	21	15	23

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APPENDIX 13.1

(Paragraph 13.5.7)

Statement X FORMAT FOR WEEKLY CROP WEATHER REPORT

GOVERNMENT OF ____________

DEPARTMENT OF ____________

WEEKLY CROP WEATHER REPORT

(for the week ending on Wednesday to be issued on Saturday)

Week No. From D/ to D/ Issued on D/

I Summary of weather conditions during the week under report

(This information has to be furnished by the Meteorologist of the India Meteorological Department. Working in the Headquarters of the State and it should contain briefly descriptions of

a) general condition of the weather in different parts of the State with stress on rainfall, temperature and wind and

b) any anamolies or hazards noticed in different parts of the State.)

II Summary of Agricultural Operations in Progress, condition of standing crops and pests and diseases.

District	Main Crops	Agricultural operations in progress.	Condition of the standing crops	Weeds, Pests and Diseases	Estimate of yield/hectare (to be furnished after the crop is in maturity)

Appendix 13.1 - Statement X (Contd)

2 1

2

3

4

5

……………………………………………………………………………………

……………………………………………………………………………………

(This information has to be furnished by the Officers of the State Department of Agriculture, working in different districts, taluks and blocks and has to be processed by the Department issuing the bulletin. A proforma of the type shown in Annexure can be developed for obtaining the information in a coded form, so that it will be easy for the officials to send the report)

III Fodder and Water supply position:

District	Fodder supply	Soil moisture condition	Water supply position		
			for drinking	From sources of irrigation like rivers, canals etc.,	Ground water position (incline or decline in ground water table)
1.	(adequate/inadequate) has to be furnished by the Officers of the Agriculture Dept. in the type of proforma shown in Annexure Item No 3	(under rainfed condition) Annexure Item 1 - f	(adequate or inadequate) Annexure Item 2	Has to be furnished by the Public Works Department of the State or Water resources Deppartment if any.	Has to be furnished by the ground water cell of the Department of Mines and Geology.
2.					

Appendix 13.1 (contd.)

IV Statement of weekly rainfall received in different taluks under report.

	District	Taluk Station	Rainfall received during the week	Normal rainfall for the week	Percentage departure from the normal	Cumulative rainfall from the commencement of the cropping season	Average rainfall that can be expected upto the date under report
1	1						
	2						
	3						
	4						
	5						
	6						
2	1						
	2						
	3						
	4						
	5						
	6						

(This information has to be collected by the Department of Economics and Statistics and has to be processed by it)

V. A General outlook of the weather conditions likely to prevail during the coming week.

(The weather foreaast for the coming week has to be furnished by the Meteorologist I/c of the forecasting Centre of the India Meteorological Department located at the Headquarters of the State.)

Appendix 13.1. (contd.)

VI Guidelines to the Farmers.

District	Crops	Suggestions for agricultural operations including plant protection measures.
I	1	
	2	
	3	
	4	
	5	

....

....

(This has to be prepared on the basis of the weather forecast and the crop condition reports by a panel of experts consisting of Agronomists, Plant Pathologists and Entomologists drawn from the State Department of Agriculture and the Agricultural Universities in the State).

Appendix 11.1 - Statement X (contd)

Annexure

DEPARTMENT OF AGRICULTURE, GOVERNMENT OF KARNATAKA

Crop Report for the Week ending on ______________

(Give the information in respect of 4 or 5 major crops grown in the area. Use the code given on the reverse side).

District: Taluk:

Name of the Crops -					
Observation	1	2	3	4	5
1. FARM OPERATIONS					
a) Preparatory tillage operations	S/P/C	S/P/C	S/P/C	S/P/C	S/P/C
b) Sowing and transplanting	S/P/C	S/P/C	S/P/C	S/P/C	S/P/C
c) Interculturing and weeding	S/F/C	S/P/C	S/P/C	S/P/C	S/P/C
d) Crop condition					
i) growth	V/N/Sn/Dr/Wi	V/N/Sn/Dr/Wi	V/N/Sn/Dr/Wi	V/N/Sn/Dr/Wi	V/N/Sn/Dr/Wi
ii) Stage of growth	Gr/Ggr/T/Hd/ Gd/M	Gr/Ggr/T/Hd/ Gd/M	Gr/Ggr/T/Hd/ Gd/M	Gr/Ggr/T/Hd/ Gd/M	Gr/Ggr/T/Hd/ Gd/M
iii) Harvesting	S/P/C	S/F/C	S/P/C	S/P/C	S/P/C
iv) Threshing	S/P/C	S/P/C	S/P/C	S/P/C	S/P/C
e) Pests, diseases and weeds					
i) Pest: Extent of damage	Mi/Mo/Sv/Ep	Mi/Mo/Sv/Ep	Mi/Mo/Sv/Ep	Mi/Mo/Sv/Ep	Mi/Mo/Sv/Ep
ii) Disease: Extent of damage	Mi/Mo/Sv/Ep	Mi/Mo/Sv/Ep	Mi/Mo/Sv/Ep	Mi/Mo/Sv/Ep	Mi/Mo/Sv/Ep
iii) Weeds: Extent of growth	Mi/Mo/Sv	Mi/Mo/Sv	Mi/Mo/Sv	Mi/Mo/Sv	Mi/Mo/Sv
f) Soil moisture condition	A/B/C/D	A/B/C/D	A/B/C/D	A/B/C/D	A/B/C/D
g) Estimate of crop yield*	Aav/Av/Bav/Po	Aav/Av/Bav/Po	Aav/Av/Bav/Po	Aav/Av/Bav/Po	Aav/Av/Bav/Po
h) Marketing of the produce*	R/S/P/C	R/S/P/C	R/S/P/C	R/S/P/C	R/S/P/C

* Furnish this when available or applicable.

2. Water Supply Position (For Livestock)	Abudant/Adequate/Inadequate/Scarcity
3. Fodder and pasture	Abundant/Adequate/Inadequate/Scarcity

Signature of the Officer & Date   Name of the Officer   Designation of the Officer

Appendix 13.1 - Statement X (contd.)
Annexure (contd.)

DESCRIPTION OF THE CODE

a) b) and c) Tillage operations, Sowing and planting and interculturing and weeding: S-Started P-In progress C-Complete

d) Crop growth: V-Vigorous N-Normal Sn-Subnormal Dr-Droughty Wi-Wilting

ii) Stage of growth: Gr-Germination, Ggr-Grand Growth, Hd-Heading, Gd-Grain development, M-Maturity, T-Tillering.

iii) Harvest and iv) Threshing: S-Started, P-In progress, C-Complete.

(e) (i), (ii) and (iii) Extent of damage by pests, Extent of damage by diseases and extent of weed growth; Mi-Mild, Mo-Moderate, Sv-Severe, Ep-Epidemic.

(f) Soil Moisture Condition: A-Optimum, B-Moderate, C-Fair, D-Poor.

(g) Estimate of Crop Yield: Aav-Above average, Av-Average, Bav-Below average, P-Poor.

(h) Marketing of produce: R-Ready for marketing, S-Started, P-In progress, C-Complete.

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Instructions: - Furnish the information in respect of 4 or 5 major crops grown in the region. Name of the crop should be furnished above the serial number for 'Crops' in the proforma.

While filling the proforma put a tick mark to whichever it is applicable. Fill in some items when applicable.

Take every possible care to provide very reliable information.

The officer furnishing the information should write his name and designation and sign at the space provided for this purpose.

Post the envelope directly to avoid delay. Post the envelope one day in advance if there is a postal holiday either on Wednesday or Thursday or Friday.

APPENDIX 13.1 (contd)

(Paragraph 13.6.2)

Statement XI Seasonal Rainfall Forecasts Issued by the India Meteorological Department

1. element period	S.W. monsoon rain (June-September)		second half SW monsoon rain (August-September)		winter precipitation (rain and snow) (January-March)
2. region	Peninsula Maharashtra, Gujarat, Madhya Pradesh, Coastal Andhra Pradesh, Telengana, Interior Mysore North, Coastal Mysore (excluding South Kanara)	N.W. India Jammu and Kashmir, West Uttar Pradesh, Haryana, Punjab Himachal Pradesh, Delhi Rajasthan	Peninsula Maharashtra, Gujarat, Madhya Pradesh, Mysore North, Coastal Mysore (excluding South Kanara) and Telengana	N.W. India Uttar Pradesh, Punjab, Haryana, Himachal Pradesh, Delhi and Rajasthan	N.W. India Uttar Pradesh Punjab, Haryana, Himachal Pradesh, Delhi, Rajasthan and Gujarat
3. normal rain (inches)	34.1	21.1	17.4	12.8	2.4
4. SD(inches)	5.1	5.4	3.9	3.8	1.2
5. factors	1. South Rhodesia Rain Oct.-April(SRr)	South Rhodesia Rain Oct.-April(SRr)	Mauritius Pressure July (Mp)	S.Am. Pressure ½(June+July)(SAp)	S.Am. Pressure December(SAp)
	2. South Am. Pressure ½(April+May)(SAP)	Equatorial ~~P~~ Pressure (EQP)	Local Pressure July ½(3+4)-(14+16)(Lp)	Local Pressure July Divisions 9,12,14,16 (Lp)	Upper Winds over N. India 5 to 8 km. ½(11 Sept.+1 Oct.)(UW)

	3. Java Rainfall(%) Oct-Feb.(Jr)	Gwalior upper winds March 2 km (G)	Java Rainfall(%) Oct-Feb (Jr)	S.Rhodesia Rain Oct-April(SRr)	Quetta Rain December(Qr)
	4. Bangalore N'ly winds April 6 km(BNGuw)	South Am.Pressure ½(April+May)(SAp)	South Rhodesia Rain Oct-April (SRr)	Punjab Temperature Range ½(April+May) (Pt)	Port Blair Rain December(PBr)
	5. Calcutta E'ly Winds May 4 km(CALuw)	Calcutta E'ly Winds May·2 km (CALuw)		River discharge Indo-Gangetic ½(April+May)(RDig)	
6. Formula	-.067 SRr+1.825·SAp -.0183 Jr+.912BNGuw -.559 CALuw-4.307 =Pm	-.183 SRr-82.4 EQp +.962(G)+.643 SAp -2.050 CALuw-1.435 =NWm	-35.6 Mp+22.3 Lp -.062 SRr-.009 Jr +.022 = Pas	+1.33 SAp-4.27 Lp -.10SRr -.672Pt -.0092RDig-.017 =NWas	+.434 SAp+.178 +.367 Qr-.039 PB -.029=NWw
7. Multiple cc	.75	.74	.63	.68	.69
8. Issue Date	1st week of June	1st week of June	1st week of August	1st week of August	1st week of January

APPENDIX 13.1 (contd)

(Paragraph 13.7.3)

tement XII Critical Periods when Weather Elements Significantly Affect Yield~~s~~ of Rice ~~and wheat~~.

Rice

ivision	period	favourable	unfavourable	remarks
	2	3	4	5
Sub-Himalayan West Bengal	1 July to 15 Sept.		dry spell for 2 weeks or more	If dry spell continues for 3 weeks or more, yield will be reduced by 12%.
	16 Sept.to 15 Oct.	rainy days	each rainy day increases the yield by 12 lbs per acre.	
	16 June to 15 July	restricted rainy days 17		
Gangetic West Bengal	16 Sept.to 15 Oct.	rainy days		Each rainy day increases yield by 11 lbs. per acre.
	July and August		dry spell of 10 days or more	If dry spell continues for 3 wee or more, yield may reduce by 50%
	June	rain over normal		Every additional 25 mm of rainfa over normal(23.6 mm) increases yield by 18 lbs/acre.
Orissa	1 Oct.to 7 Oct.	rainfall		Increase in yield by 24 lbs/acre for each 25 mm of rainfall.
	19 Sept. to 25 Sept.	range of temperature		Increase in yield by 24 lbs/acr for each degree Farenheit(0.6C) increase in range of temperatur
	10 Oct. to 18 Nov.		heavy rain	Decreases yield by 10 lbs/acre.

	2	3	4	5
Bihar	16 Sept. to 15 Oct.	rainfall	rainy days exceeding 8 to 10 days	Yield increases by 28 lbs/acre in Bihar plateau and 19 lbs/acre in Bihar plains for each rainy day.
	June	rainfall	heavy rain in the first three weeks	
Uttar Pradesh (East)	1 Aug. to 15 Sept.		absence of rain for 10 days or more	Yield reduces by 70% if rain is absent for 21 days or more.
	24 Aug. to 30 Sept.	rainfall		Increases yield by 8 lbs/acre for every 25 mm of rain during this period.
	September	range of temperature		Increases yield by 14 lbs/acre fo each degree Farenheit(0.6C) increa in range of temperature.
Uttar Pradesh (West)	1 Aug. to 15 Sept.		Absence of rain for 10 days or more	Yield reduces by 35% if rain is absent for 21 days or more.
	26 July to 24 Sept.	rainfall		Increases yield by 6 lbs/acre fo every inch (25 mm) of rain during this period.
	27 July to 1 Aug.	cloudiness		Each okta of cloudiness increase yield by 29 lbs/acre.
Punjab	1 Aug. to 15 Sept.		Absence of rain for 10 days or more	10 to 15% reduction in yield if does not rain continuously for 2 days or more.
	25 Sept. to 9 Oct.		rainfall	For every 25 mm of rainfall du this period, yield may reduce b 21 lbs/acre.
	4 July to	rainfall		Increase in yield 8 lbs/acre fo every 25 mm of rainfall.

	2	3	4	5
Haryana	3 Aug. to 13 Aug.	rainy days		Increase in yield 38 lbs/acre for each rainy day.
	19 June to 25 June	rainfall		For each 25 mm of rain, increase in yield is 75 lbs/acre
Konkan	1 July to 30 Sept.		Dry spell, floods on more than 30 occasions	Yield can reduce as much as 15%.
	June to Aug.	higher rainfall		Relationship logarithmic
	July to Sept.	cloudiness		
	July to Aug.	normal mean temperature		
Madhya Maharashtra	July	rainy days		Yield increases by 34 lbs/acre for each rainy day.
	August		dry spell of 10 days or more	Dry spell of 3 weeks reduces yield by 35%.
Vidarbha	18 June to 24 June	rainfall		Increases yield by 20 lbs/acre for each 25 mm of rainfall.
	22 Aug. to 30 Aug.	rainfall		Increases yield by 20 lbs/acre for each 25 mm of rainfall.
	1 July to 15 Sept.		Absence of rain for 8 days or more	If dry spell continues for 3 weeks or more, yield is reduced by 40%.
Coastal Andhra Pradesh	October	rainfall		Increase of 30 lbs/acre for each rainy day.
	Aug. to Sept.		Dry spell exceeding 3 weeks	Dry spell for more than 4 weeks reduces yield by 15 to 20%.
13. Telangana	July		rainfall exceeding 8" in the first three weeks	
	11 to 26 Aug. and 6 to 15 Oct.	rainfall		Each 25 mm. of rain during these periods increases yield by 19 lbs/acre

	2	3	4	5
[illegible]. Tamil Nadu		more than normal rainfall during second half of May and June in Mercara and Bhagmandala area		Rainfall exceeding normal by 20% during each period increases yield by 40 to 60 lbs/acre.
[illegible] Coastal ~~Mysore~~ Karnataka	June		more than normal rainfall	
	Aug. and Sept.		dry spell of 18 days or more	
	1 July to 15 Sept.	restricted rainy days		
	July and August	normal maximum temperature		
[illegible] Interior ~~Mysore~~ Karnataka North	July	rainfall		Increase of yield for each 25 mm of rain 25 lbs/acre.
	Aug. & Sept.		18 days or more of dry spell	If dry spell continues for 28 days or more yield can decrease 40 to 50%.
	July to Sept.	mean maximum temperature about 30°C		
[illegible]. Interior ~~Mysore~~ Karnataka South	June	rainfall		Increase in yield for each 25 mm of rain 60 lbs/acre.
	July & August		dry spell of 18 days or more	If dry spell continues for 18 days or more, yield decreases by 15 to 20%.
	September	rainfall		Yield increases by 50 lbs/acre for every 25mm of rain .
[illegible]. Kerala	16 June to 1 Aug.		dry spell of 18 days or more; 3 or more occasions of floods	Yield may decrease by about 15%.

APPENDIX 13.1 (contd)

Statement XIII (Paragraph 13.7.7)

Percentage Variation in Yield of Rice Accounted for by Technology

~~Rice~~

S.No.	sub-division	total percentage accounted by regression	percentage variation accounted by technology
1.	Sub-Himalayan West Bengal	68.4	8.4
2.	Gangetic West Bengal	68.8	16.4
3.	Bihar Plateau	67.3	8.3
4.	Bihar Plains	70.4	11.4
5.	Konkan	57.7	no trend noticed
6.	Madhya Maharashtra	81.2	no trend noticed
7.	Vidarbha	84.3	14.5
8.	Coastal Andhra Pradesh	83.0	45.7
9.	Telangana	73.0	17.0
10.	Tamil Nadu	77.8	20.8
11.	Coastal Karnataka	80.1	9.5
12.	Interior Karnataka North	85.4	20.4
13.	Interior Karnataka South	93.6	34.3
14.	Kerala	93.0	31.5
15.	Orissa	89.0	16.0
16.	Uttar Pradesh East	85.4	4.2
17.	Uttar Pradesh West	79.8	5.9
18.	Haryana	96.2	20.4
19.	Punjab	88.0	19.2

APPENDIX 13.1 (contd)

(Paragraph 13.3.7)

Statement XIV WMO STATEMENT ON WEATHER MODIFICATION

At its twenty-sixth session (Geneva, June 1974) the Executive Committee approved a revised version of the WMO statement on weather modification made by the Sixth Congress (1971). The text of this revised statement is given below.

Present state of knowledge and possible practical benefits in some fields of weather modification

General

It has been demonstrated that ice crystals may be caused to form in supercooled clouds by seeding them with dry ice, silver iodide and other nucleants. Ice crystals are known to play an important role in the process of formation of precipitation; cloud seeding therefore provides a means of modifying the precipitation process in some types of supercooled clouds. The seeding of a supercooled cloud converts it to ice, releasing latent heat which can have important dynamical effects. The varied and controversial results of seeding experiments appear to be due to the complexities of the dynamics and microphysics of the principitation process. An encouraging beginning in the understanding of these processes has been made through the development of numerical models which incorporate both the dynamics and microphysics and their interactions. Such models and their successors may be expected to define more clearly the most favourable seeding situations and the observations needed for the evaluation of the results. Although some experiments have apparently yielded positive results, the possible practical benefits of weather modification can be realized only through an increased research effort. This research should be directed primarily at cloud dynamics and mesoscale dynamics and the interactions of dynamics with microphysics, since knowledge of the latter is relatively more complete. There is a great need for simultaneous measurements of dynamical and microphysical parameters.

Some experiments have been made to test the possibility of seeding warm clouds with hygroscopic particles or water droplets in order to increase precipitation . The results obtained from these experiments have not been conclusive or sufficiently postive.

It appears that the most sophisticated statistical procedures are an inadequate substitute for more complete knowledge of the atmospheric mechanisms. However, statistical design and evaluation of experiments are both necessary to increase our understanding of physical aspects in the further development of weather modification, particularly in connexion with the valuation of the practical results of experiments.

It is important to emphasize that weather modification is still largely at the research stage. For this reason, operations should be undertaken only after the most careful study by experts of the particular situation, and on the understanding that the desired end results may not always be achieved.

Brief summaries of the current status of weather modification in several categories are given below.

Stimulation of precipitation

Of the many experiments conducted in this field, only a few have clearly demonstrated that seeding has increased the precipitation; in some cases, there is evidence of a decrease. However, these apparent contradictory results seem to emerge from the fact that, in different geographical locations, clouds have different cloud-droplet spectra and different ice crystal properties and concentrations. There is some evidence that winter-time orographic precipitation can be somewhat increased over mountain ranges. Similar results have also been obtained in subtropical, continental cumulus clouds in winter.

There is some evidence that certain subtropical convective clouds become taller and larger, with a tedency to merge, when they are heavily seeded to release latent heat.

In view of the high correlation between the size of convective clouds and the rainfall from them, the seeded clouds presumably give more rainfall than if they had not been seeded. Confirmation is required from further suitably designed experiments.

Dissipation of fog

Supercooled fog and stratus can be dissipated by growth and sedimentation of ice crystals, induced by seeding the fog with ice nucleants or by means of cooling agents. This has been brought into operational use at several airports at which there is a relatively high incidence of supercooled fog. The more common warm fog may be dissipated by the use of heat, hygroscopic particles and the down-wash of helicopters. Successful experiments have been reported with each of these techniques, but only the use of heat seems operationally viable at present.

Hail Suppression

Many countries have focused considerable attention on hail suppression projects in the last decade or so. In spite of the complexity of the hail-forming processes and the extremely large variability in hail occurrence which make hail suppression experiments very difficult to assess, there appear to be promising prospects of success in the near future.

Impressive reports of successful reduction in hail damage

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to crops, with resulting economic benefit, have provided impetus to many experiments and large mainly operational projects. As yet, there are no universally rec-ognized methods and the results to date are not unambiguous. The seeding methods produce different effects on different storms, and it is essential that detailed understanding of the structure and the processes of various types of storms be obtained so that seeding procedures specially tailored to the specific atmospheric conditions can be determined. The development of numerical models is of great importance for the future understanding of the processes within cumulonimbus clouds. These models should incorporate proper dynamics and thermodynamics with details of the microphysics and water phase transition processes and their interaction. This approach should be tested against detailed direct measurements of cloud properties.

More basic research is required to resolve questions on various hailstorm theories, models and suppression techniques. Development of more reliable evaluation methods based on both physical and economic indicators is also needed.

Hurricance Modification

The seeding of hurricanes has been followed by reduced maximum wind velocities. Confirmation is required from further experiments which should include an increased number of measurements in pertinent regions of the storm. This is because assessment will largely depend upon physical methods rather than statistical ones. There is also need for improved numerical hurricance models to provide guidance for future experiments.

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Other aspects

Exploratory investigations are being conducted into the suppression of forest and bush fires , the inducement of down-draughts in developing convective clouds and the prevention of lightning. Attempts are also being made to seed cold ice-supersaturated layers of the atmosphere in order to produce clouds, with the object of preventing the formation of radiation fog.

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APPENDIX 13.2

List of Maps

Map number	Reference paragraph	
I	13.2.3	Normal Rainfall, July
II	13.2.3	Normal Rainfall, June - September
III	13.2.3	Normal Rainfall, Annual
IV	13.2.13	Coefficient of Variation of Rainfall, July
V	13.2.13	Coefficient of Variation of Rainfall, June - September
VI	13.2.13	Coefficient of Variation of Rainfall, Annual
VIa	13.2.3	June - September Rainfall as Percentage of Annual
VII	13.2.5	Dates of Onset and Withdrawal of Southwest Monsoon
VIII	13.2.17	Mean Departure (%) of Rainfall during breaks
IX	13.2.17	Percentage Difference between average number of rainy days during break periods and during July - August
X	13.2.22	Duration of Sunshine (Hours)
XI	13.2.22	Percentage Frequencies of number of days of bright sunshine greater than (>) 9 hours
XIa	13.2.23	Daily Global Solar Radiation
XIb	13.2.23	Daily Diffuse Solar Radiation

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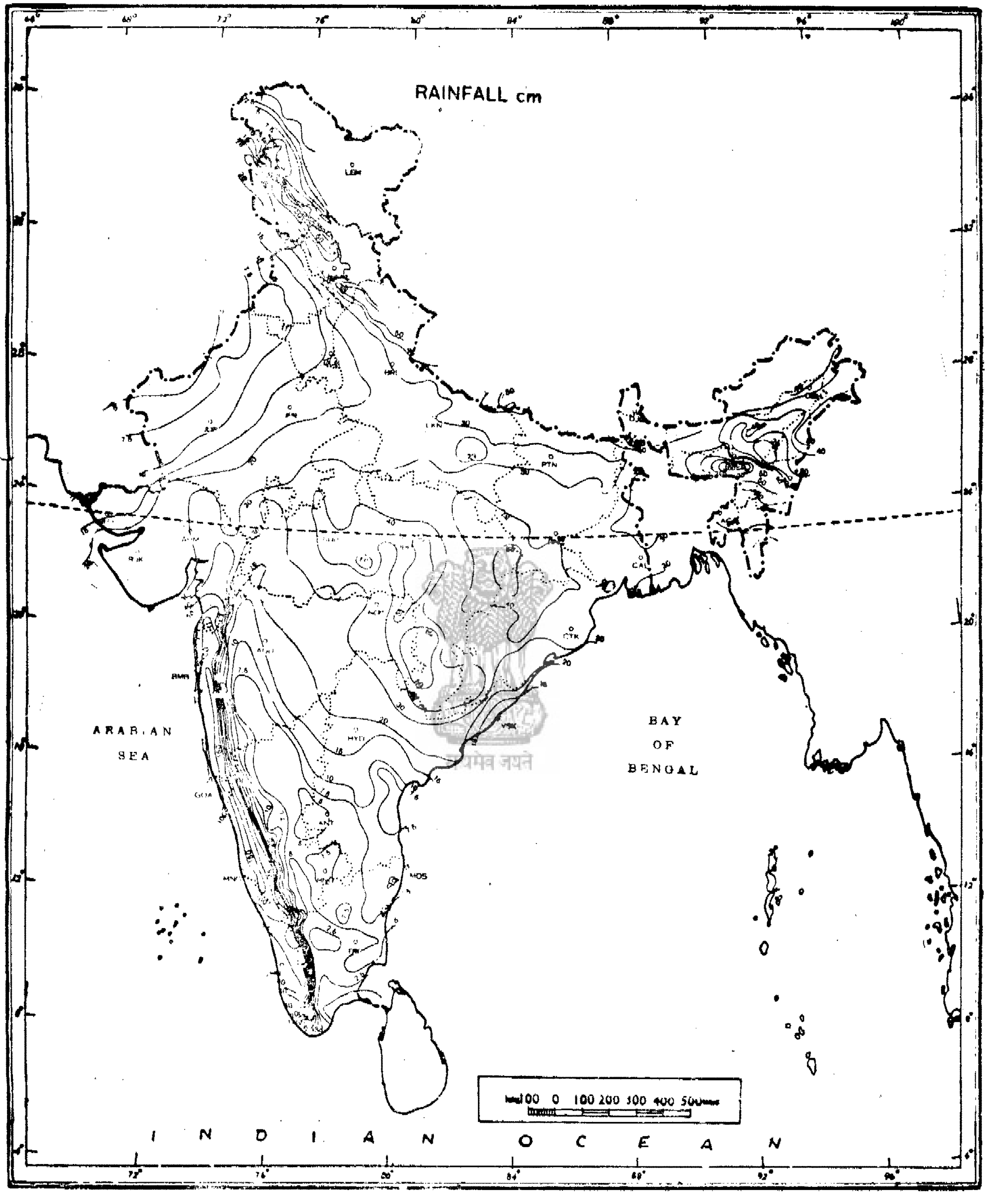
APPENDIX 13.2 MAP I (July) (Paragraph 13-2-3)



Based upon Survey of India Map with the permisson of the Surveyor Generel of India

The territorial Waters of India extend into the sea to a distanse of twelve nautical miles measured from the approprlate base line

The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be varified

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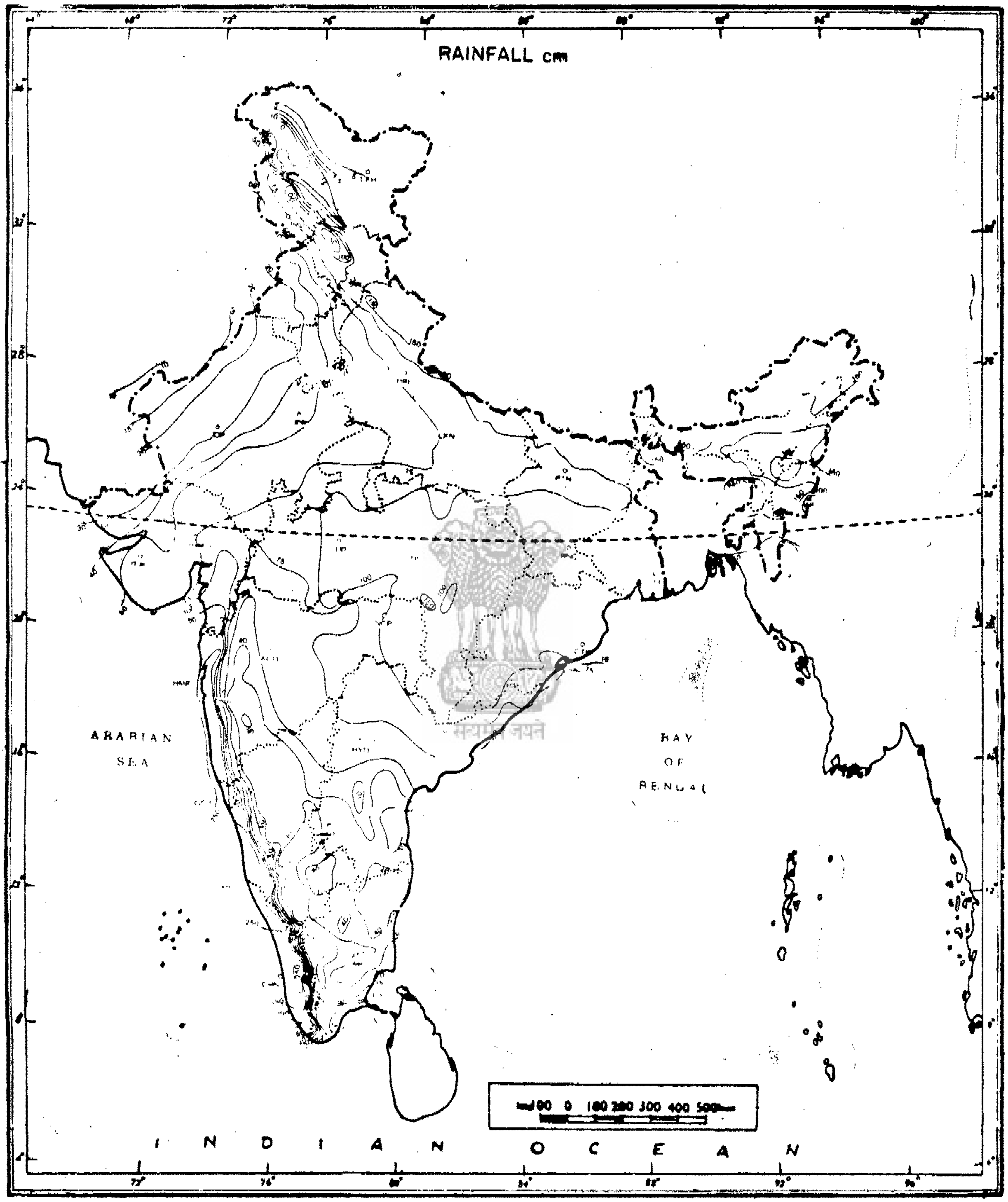
APPENDIX 13.2 MAP II (June-September) (Paragraph 13-2-3)



Based upon Survey of India Map with the permisson of the Surveyor General of India
The territorial Waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line
The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be verified

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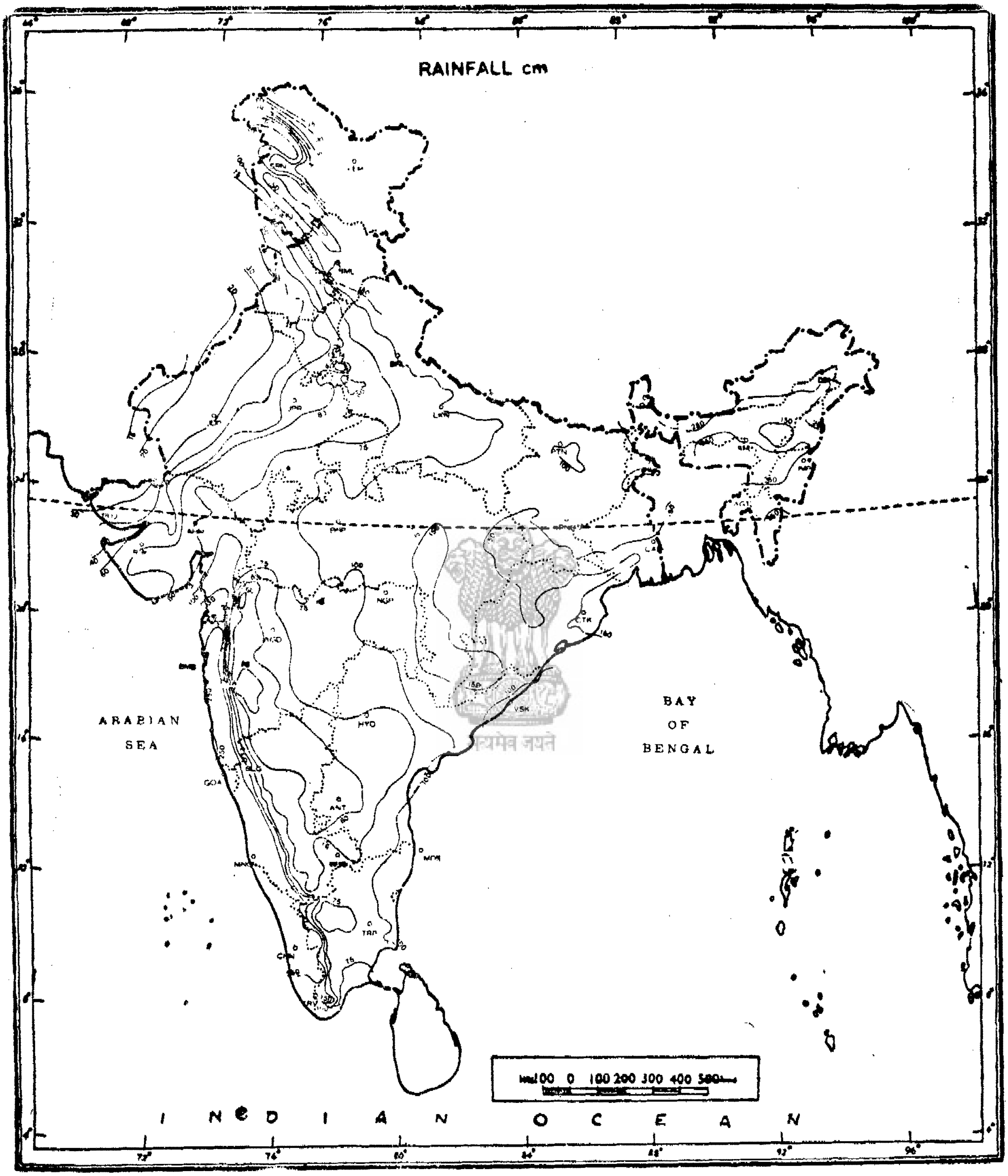
APPENDIX 13.2 MAP III (Paragraph 13-2-3)



Based upon Survey of India Map with the permisson of the Surveyor General of India

The territorial Waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line

The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be varified

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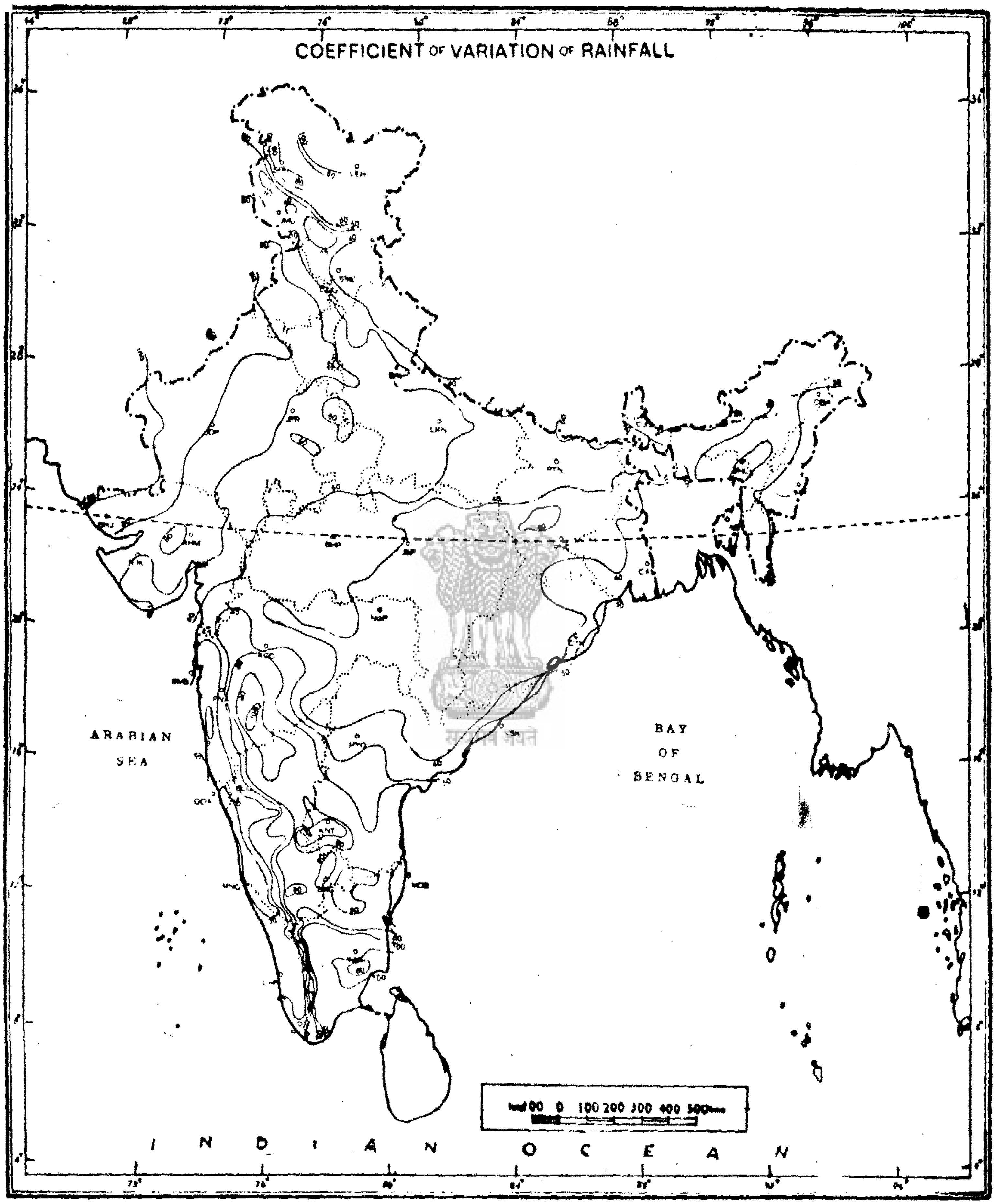
APPENDIX 13.2 MAP IV (July) (Paragraph 13-2-13)



COEFFICIENT OF VARIATION OF RAINFALL

Based upon Survey of India Map with the permisson of the Surveyor General of India

The territorial Waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line

The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be varitied

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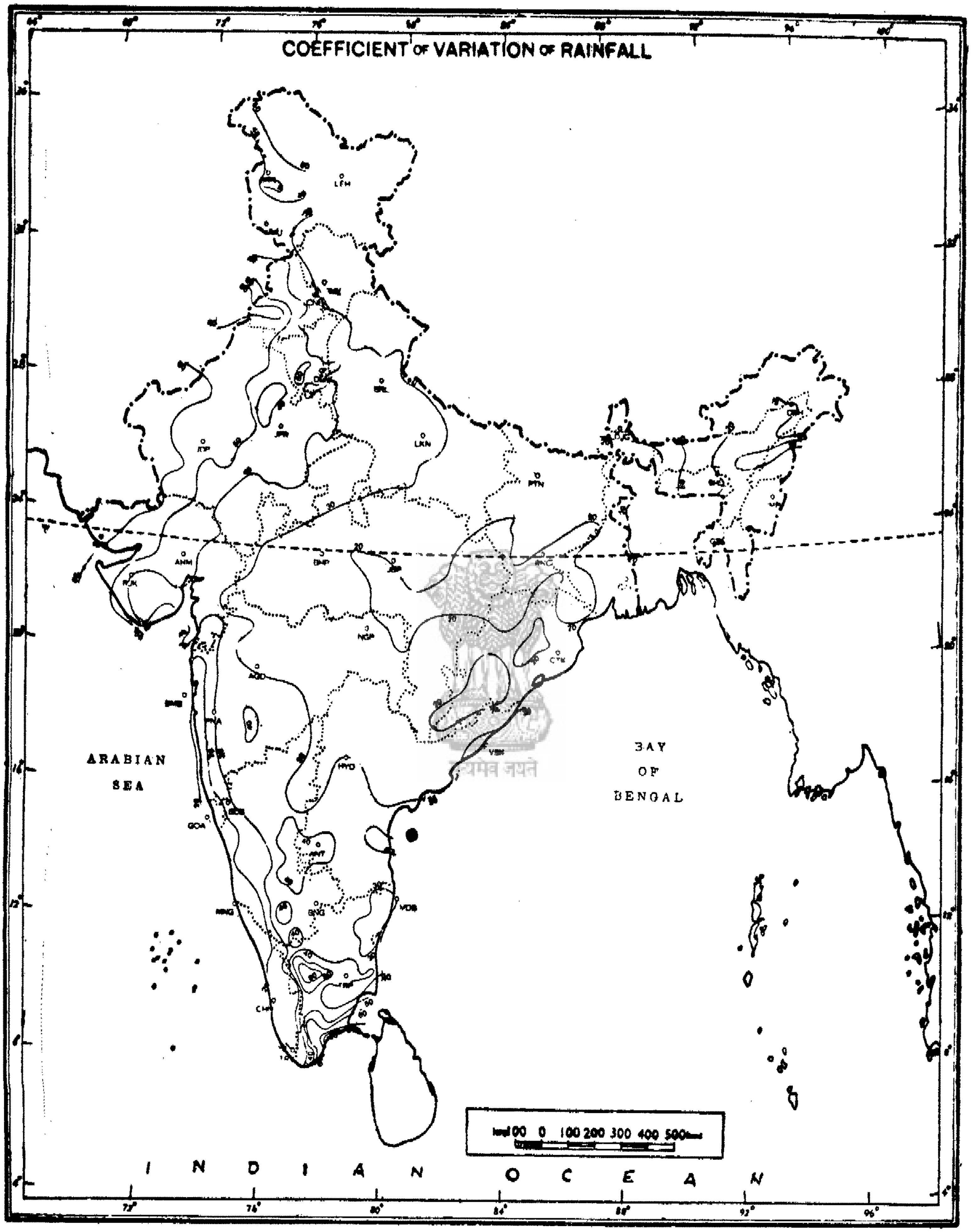
APPENDIX 13.2 MAP V (June-September) (Paragraph 13-2-13)



Based upon Survey of India Map with the permisson of the Surveyor General of India

The territorial Waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line

The boundary of Meghalaya shown on this map is as interpreted from the North Eastern Areas (Reorganisation) Act, 1971, but has yet to be varified

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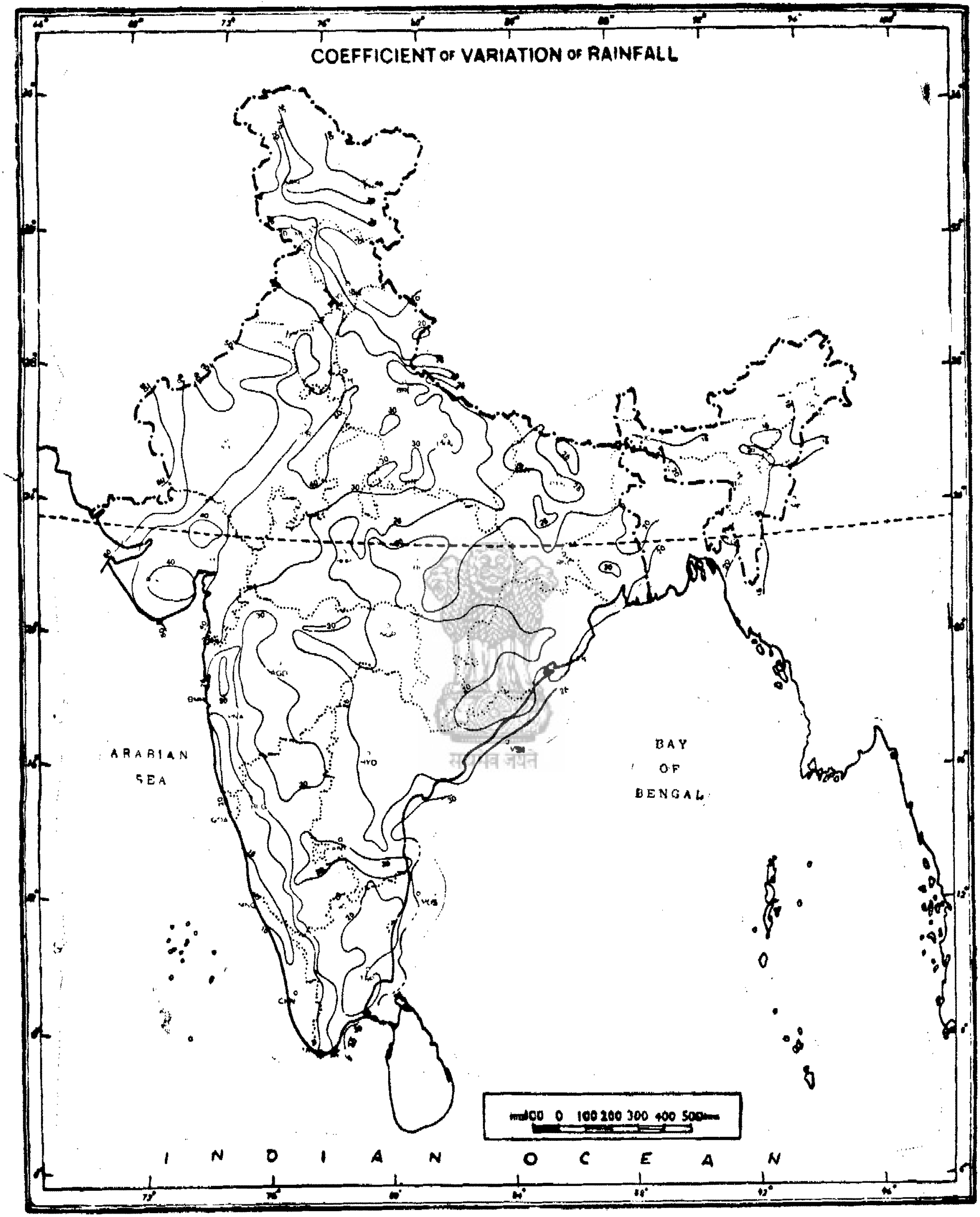
APPENDIX 13.2 MAP VI (Annual) (Paragraph 13-2-13)



COEFFICIENT OF VARIATION OF RAINFALL

Based upon Survey of India Map with the permisson of the Surveyor General of India

The territorial Waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line

The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be varified

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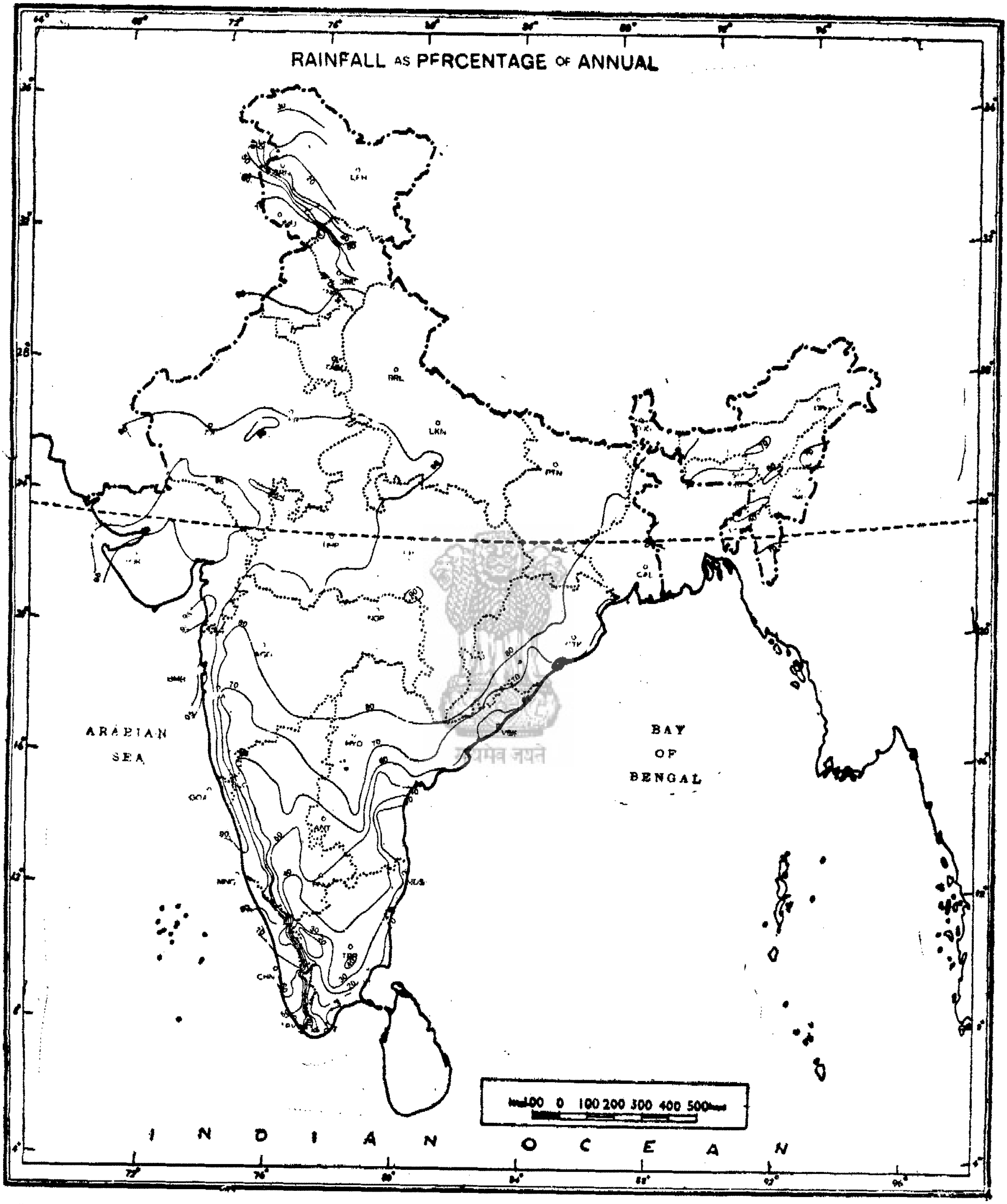
APPENDIX 13.2 MAP VI a (June-September) (Paragraph 13-2-3)



RAINFALL AS PERCENTAGE OF ANNUAL

Based upon Survey of India Map with the permisson of the Surveyor Generel of India

The territorial Waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line

The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be varified

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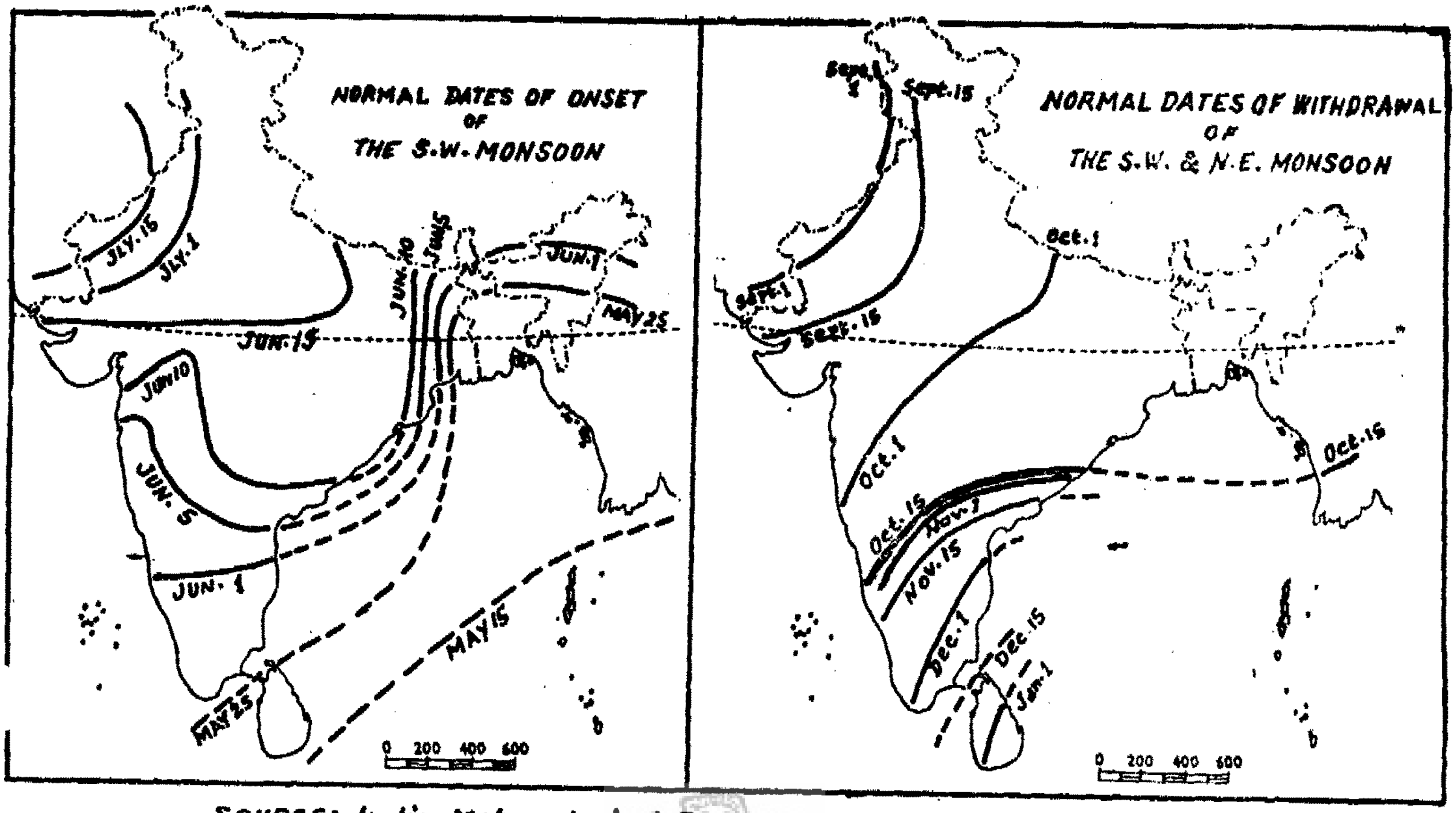
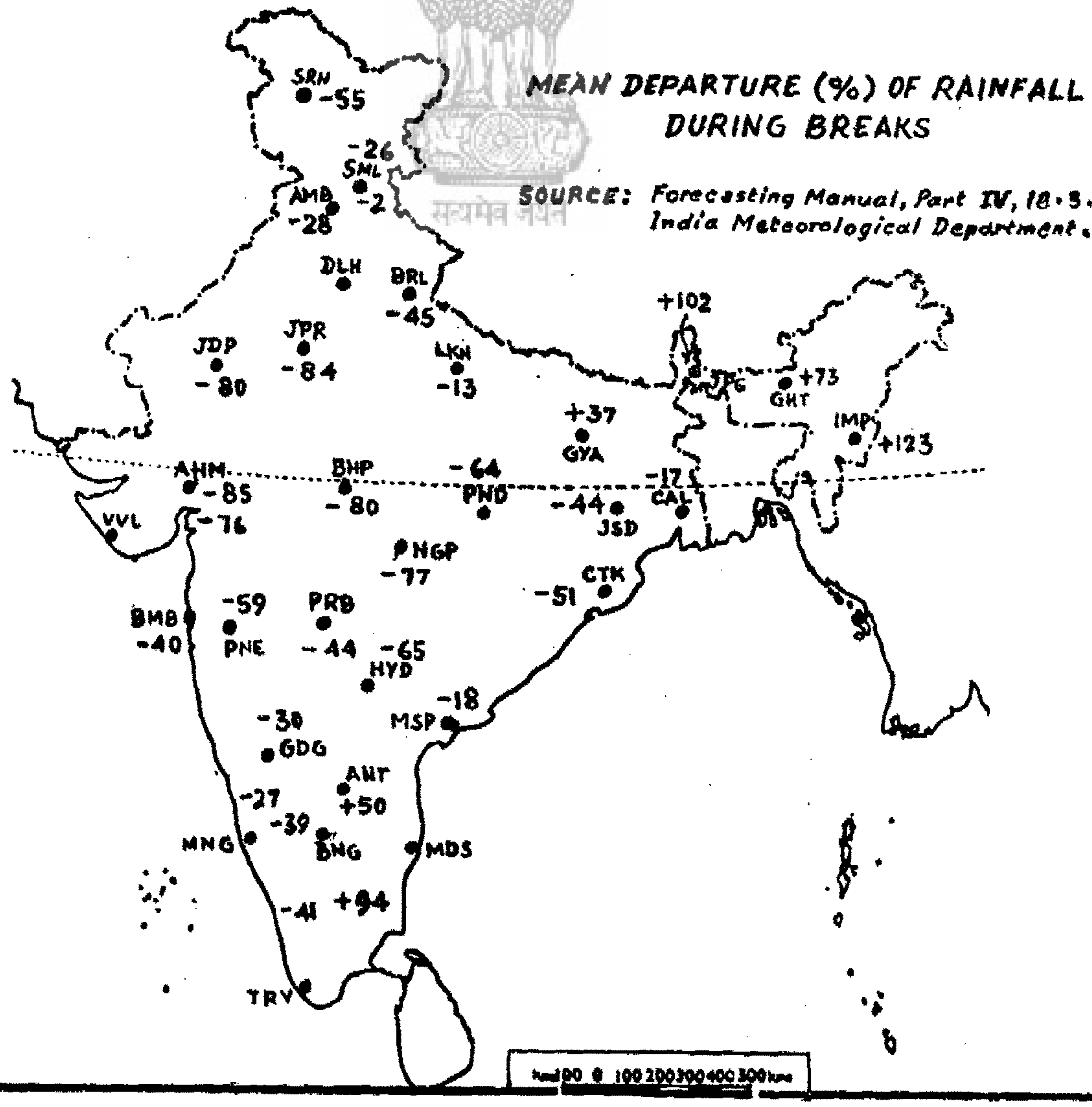
Appendix 13·2

Maps VII



SOURCE: India Meteorological Department.

Map VIII



MEAN DEPARTURE (%) OF RAINFALL DURING BREAKS

SOURCE: Forecasting Manual, Part IV, 18·3., India Meteorological Department.

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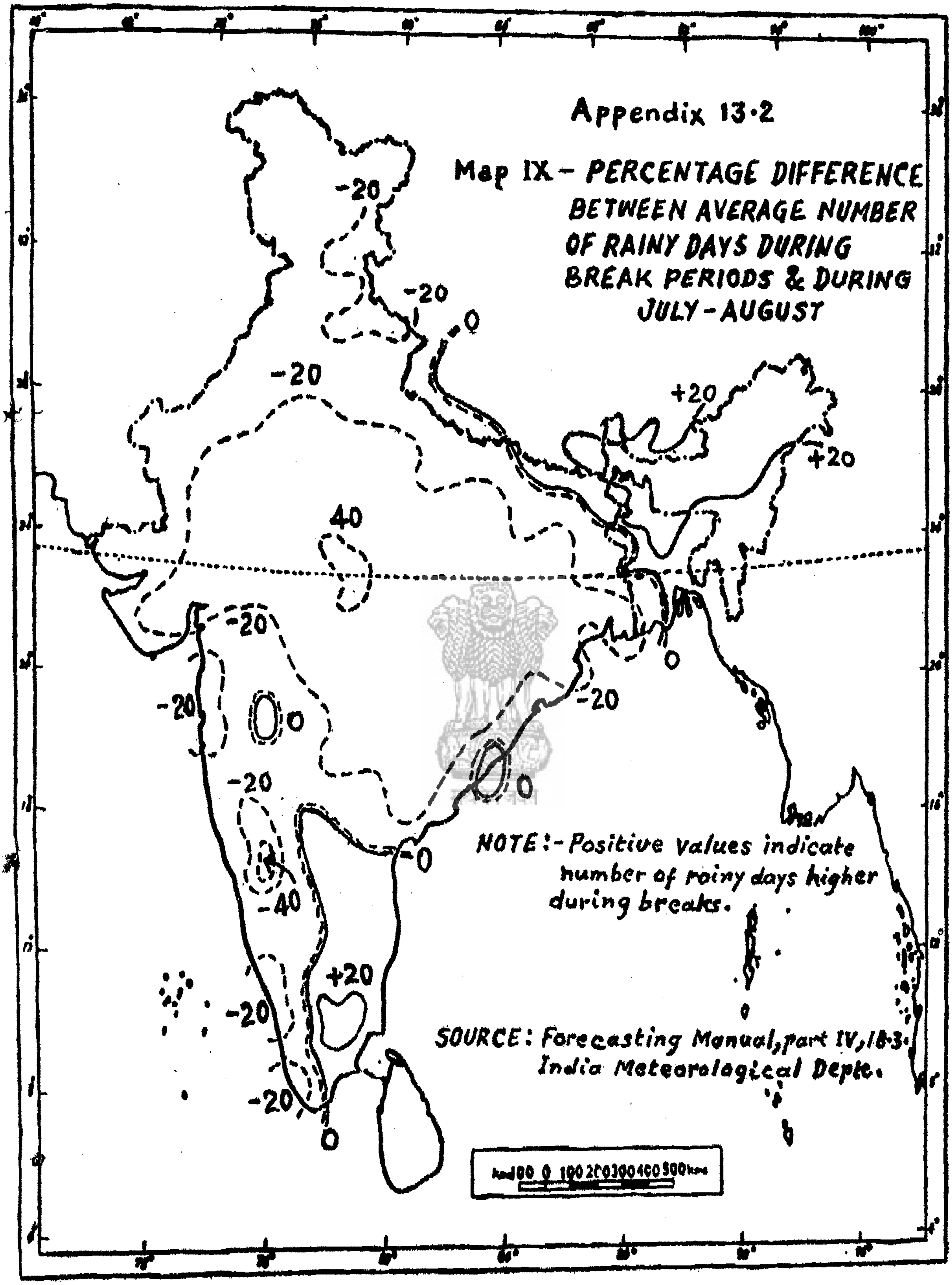
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line



Appendix 13·2

Map IX – PERCENTAGE DIFFERENCE BETWEEN AVERAGE NUMBER OF RAINY DAYS DURING BREAK PERIODS & DURING JULY – AUGUST

NOTE:- Positive values indicate number of rainy days higher during breaks.

SOURCE: Forecasting Manual, part IV, 18·3. India Meteorological Deptt.

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

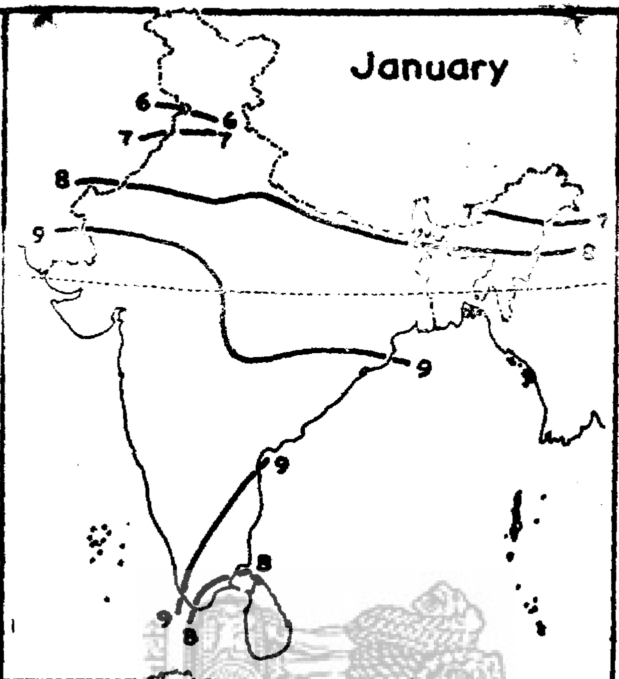
Appendix 13·2

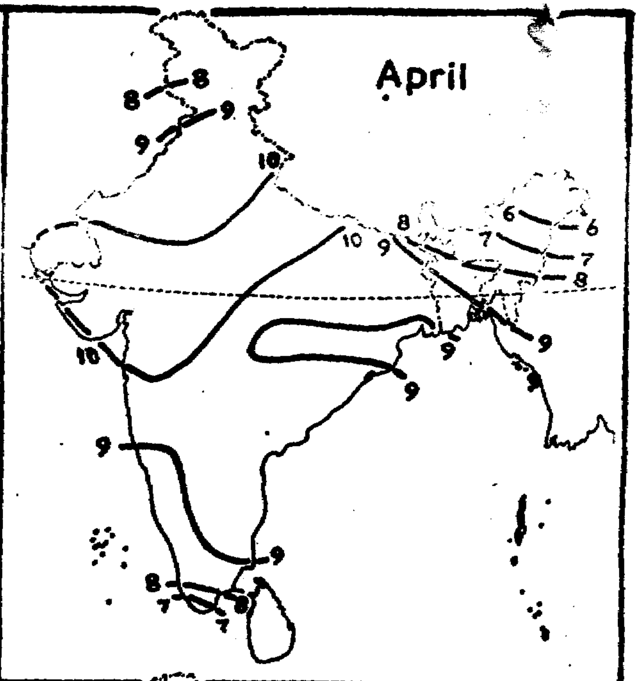
Maps X - DURATION OF SUNSHINE (Hours)

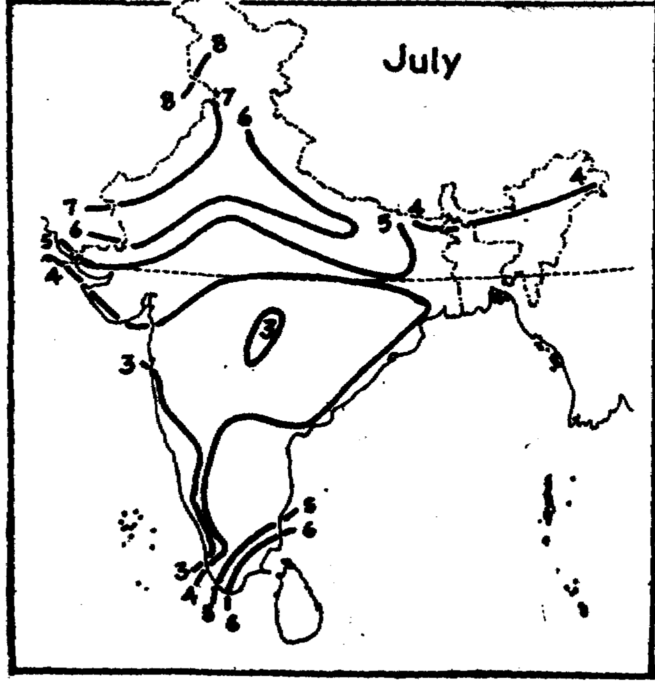
SOURCE: *Prepublished Scientific Report 1972, India Meteorological Department.*

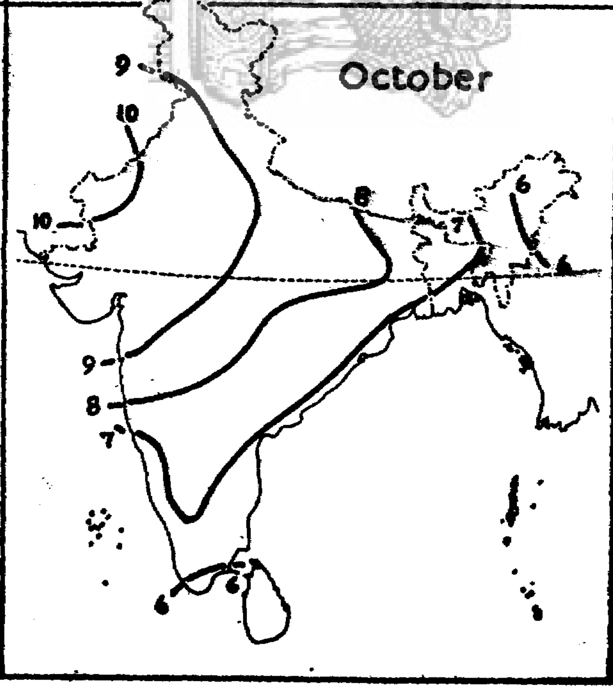
0 200 400 600

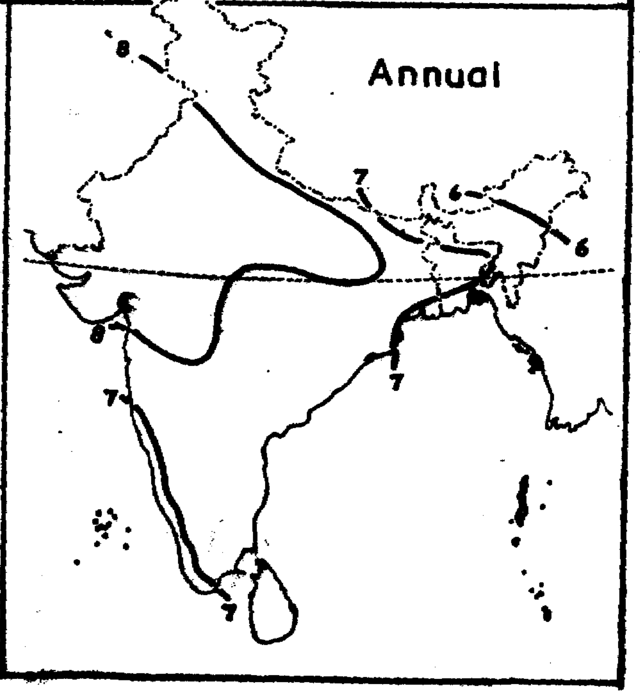
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.


January


April


July

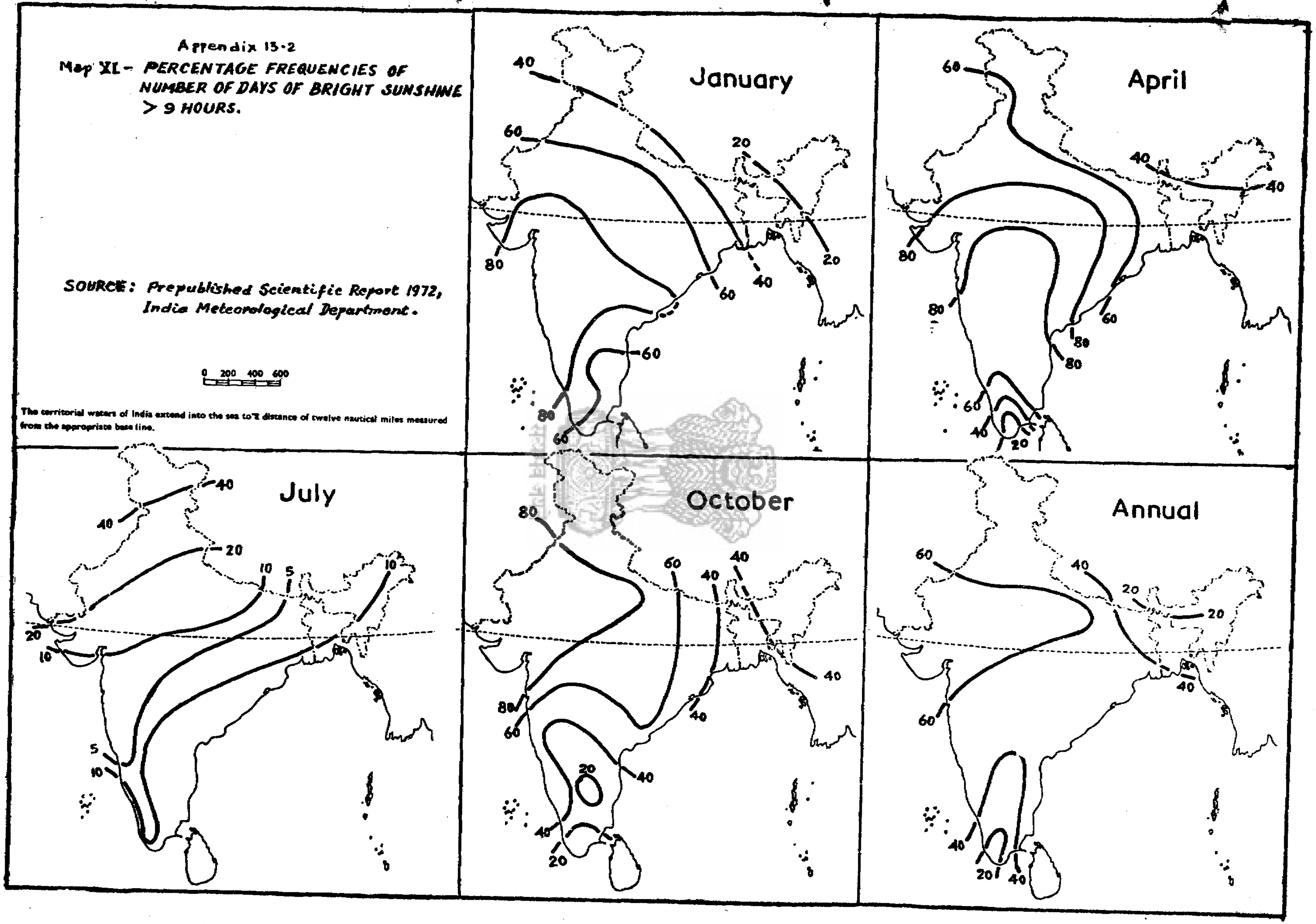

October


Annual

Appendix 13·2

Map XI – *PERCENTAGE FREQUENCIES OF NUMBER OF DAYS OF BRIGHT SUNSHINE > 9 HOURS.*

SOURCE: Prepublished Scientific Report 1972, India Meteorological Department.



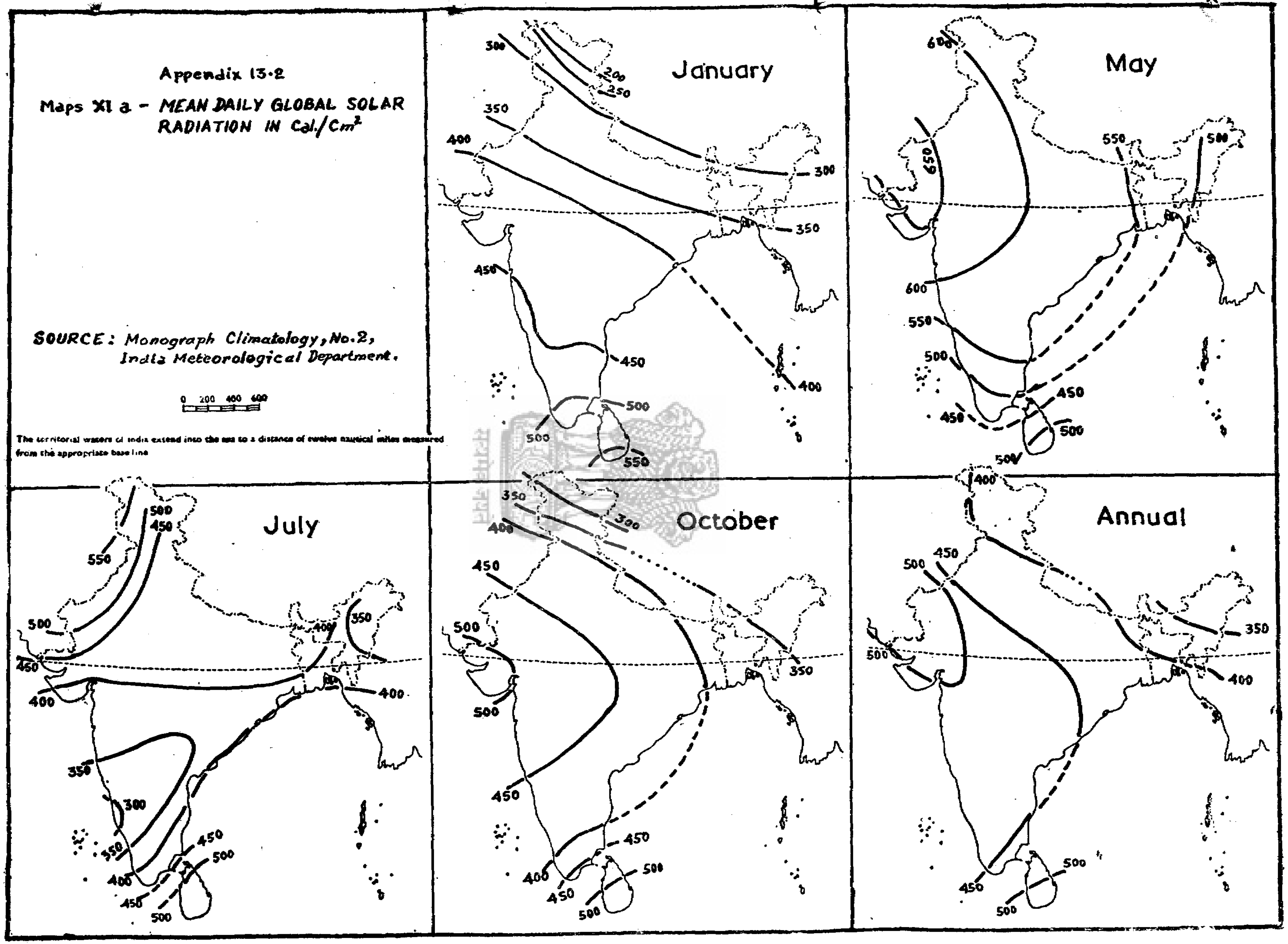
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

Appendix 13·2

Maps XI a - MEAN DAILY GLOBAL SOLAR RADIATION IN Cal./Cm^2

SOURCE: Monograph Climatology, No. 2, India Meteorological Department.

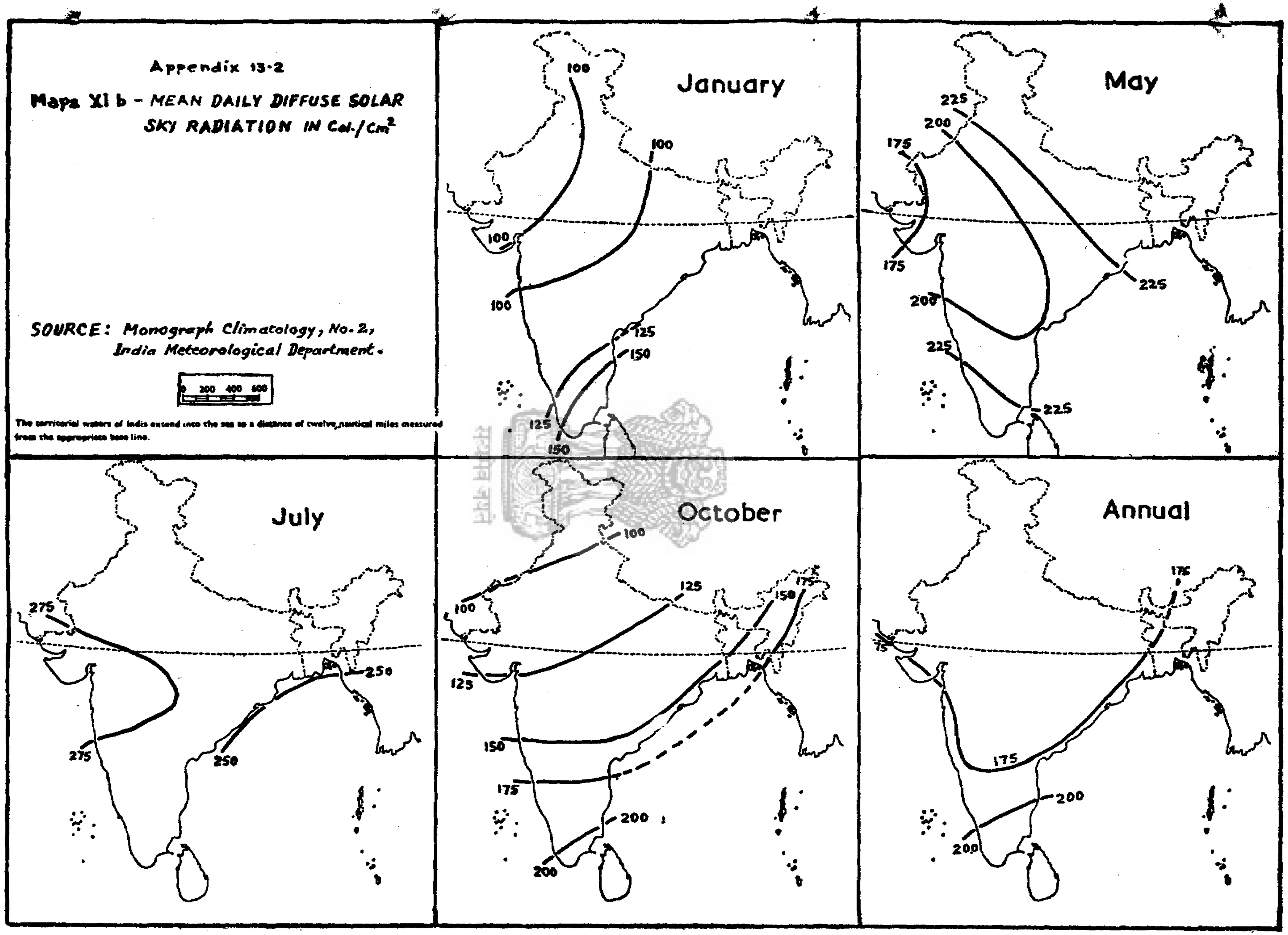
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line



Appendix 13·2

Maps XI b – *MEAN DAILY DIFFUSE SOLAR SKY RADIATION IN Cal./Cm²*

SOURCE: Monograph Climatology, No. 2, India Meteorological Department.



The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

14

RAINFALL AND CROPPING PATTERNS

14

RAINFALL AND CROPPING PATTERNS

1 INTRODUCTION

14.1.1 The population of the country which was 548 millions in 1971 is estimated to reach about 935 million mark in 2000 AD, which surely necessitates increased agricultural production. Land resources being limited, emphasis has to be placed on increasing productivity per unit area. Temperature and other climatic conditions being favourable throughout the year over most parts of the country, it is possible to grow more than one crop in a year provided water is available. In some parts of the country the spread of rainy season is long enough to provide ample scope for double cropping. This potential is yet to be fully exploited. There is undoubtedly scope for increasing irrigation resources in the country, but our estimates show that the area under irrigation is not expected to be more than 42 per cent of the total cropped area in 2000 AD, although it would mean considerable improvement over the percentage of 22 in 1970-71. Therefore, judicious utilisation of direct rainfall and irrigation water, singly and in combination, will have to be thought of for increasing production.

14.1.2 Farming technology has so advanced that it is possible to increase crop yields even under rainfed conditions, but the choice of crops would have to depend upon the amount and distribution of the prevailing rainfall. Additionally, it will be necessary that the maximum possible quantity of rain water is conserved in ponds and pools situated either within the farm area or elsewhere, in soil profiles and underground storages so that the same could be readily used to save crops in times of stress. Not only in rainfed farming but even under irrigated conditions, one will have to plan for the most economic and efficient use of water to derive maximum possible benefit from rainfall reducing dependence on irrigation so that the advantage of availability of water could be extended to as large an area as possible. This necessitates a close study of the existing cropping patterns vis-a-vis rainfall patterns aimed at determining the nature of changes needed in cropping patterns to make the maximum use of rain water. The cropping patterns depend primarily on soils and climatic factors, but as they evolve, also represent the integrated effect of the requirements, local habits and economic factors through time. In the context of increasing production, it is necessary to examine them from a scientific angle and find out possible alternative patterns having higher potential. Accordingly, the Commission undertook a comprehensive study of the rainfall and cropping patterns of the country, using taluk as unit of area. The study covered several other relevant factors also to facilitate an integrated assessment, viz., orography, land use pattern, human and livestock populations, and power availability for cultural operations ,soils and climate.

14.1.3 The detailed data on rainfall and crops collected would enable one to delineate the country into suitable agro-climatic regions, as crops represent the integrated effect of several natural factors including soils. The extensive crop and related data thus collected and processed

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during the present study should provide a valuable source of reference particularly for planning at levels ranging from taluk to all-India, besides its utility for the main purpose of arriving at the future cropping patterns. The initial processing of data and study was done for each State separately. In view of their importance the basic data and the results of study together with all relevant tables and maps are being published separately in the form of State Volumes. The report on 'Rainfall and Cropping Patterns of Karnataka' is included as an Appendix at the end to serve as an illustration. This chapter consists of nine sections. The methods followed for defining rainfall, cropping and livestock patterns are explained in section 2 on Methodology. A brief review of the different factors being covered is also included. Section 3 deals with general information on area, population, land use, irrigation, soils and livestock. Rainfall patterns - zones are analysed in section 4. Areas, both geographical and gross cropped, are shown against each pattern for the seasons June to September, October to January and February to May separately. The rainfall zones of section 4 have been grouped to form regions with a few simplifications and approximations and these are considered in section 5. The regions form the basis of study for crops etc. A list of the regions together with particulars of geographical and gross cropped areas is included. In addition, a comprehensive Appendix 14.6 - statement V giving the details of taluks/subdivisions in each Region with cropping patterns of State areas in each region and indication of percent irrigated areas in the districts in the region has also been prepared. Section 6 is devoted to cropping patterns of regions but a list of patterns in each State is also included. While discussing cropping patterns in each region, the suitability of the present cropping structure and suggestions for improvement have also been included. Area, distribution and yield of some selected crops have also been analysed. This section includes also a summary of the Reports prepared by some of the States. Section 7 gives suggestions for future cropping patterns. The last section contains a summary of conclusions and recommendations. A number of statements and maps showing rainfall, cropping and livestock patterns etc. are included as appendices at the end.

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2 METHODOLOGY

14.2.1 The methodology followed in the study is described in this Section. The chief features of the study are (a) use of taluk or tehsil as unit of area; (b) introduction of the coded numerical form to express patterns of distribution of rainfall for the whole year, as also of crops and livestock; (c) inclusion of information on orography, temperature, evapotranspiration, rainfall, soils, irrigation, land use, human and livestock populations, power availability for field operations and yield performance of crops, all of which influence in different ways and degrees the cropping patterns of a place and (d) presentation of coded information on rainfall, crops etc. on maps of scale 1 : 1 million.

Rainfall Patterns

14.2.2 As stated in Chapter 13 on Climate and Agriculture, a major feature of Indian rainfall is that 70 to 95 per cent of the annual rainfall occurs during the southwest monsoon months of June to September throughout the country, except in the south east peninsula and Kashmir and adjoining hill areas. The monsoon as well as annual rainfall show large fluctuations from year to year, but as stated in Chapter 13 on Climate and Agriculture, there is no evidence of any significant trend or periodicity in them when examined over a long period. July and August are in general the rainiest months. When rainfall is considered in relation to crop production the annual or seasonal totals do not have much significance compared with the totals for smaller intervals. A relevant question therefore

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to be considered is whether rainfall should be examined on a weekly, fortnightly or monthly basis. The coefficient of variation (CV) of monthly rainfall is as high as 40-50 per cent even in the rainiest month of July over most of the central, northern and eastern India. In the south excluding west coast, CV is 60 to 100 per cent. The variability of weekly or fortnightly rainfall is many times greater. This is a major difficulty in using weekly and fortnightly rainfall as dependable indicators of rainfall distribution. Therefore, while studies for individual or specific problems on the basis of weekly or fortnightly rainfall data have their own utility in spite of their high variability, for a macro-study like the present one for the whole country, monthly data are most convenient.

14.2.3 In order to facilitate examination of the distribution of rainfall during periods of crop growth, limits of rainfall which have closer relation to broad requirements of crops, have been drawn up. The time span of most of the crops is usually of the order of 90 days or longer. Keeping this in view, the following limits have been used in the study:

i) Rainfall of greater than 30 cm per month (pm) for at least three consecutive months would be suitable for a crop like paddy whose water need is very high;

ii) 20-30 cm pm for not less than three consecutive months would be suitable for crops whose water need is high but less than that of paddy, for example, maize and black gram;

iii) 10-20 cm pm for at least three consecutive months is considered suitable for crops requiring much less water, e.g. bajra and small millets;

iv) 5-10 cm pm is just sufficient for crops which are low water requiring, e.g. moth (p. aconitifoliu and ephemeral grasses; and

v) Rainfall less than 5 cm pm is not of much significance for crop production.

14.2.4 For denoting the year's rainfall distribution using monthly totals, a code having letters of the alphabet with numerical subscripts is employed. The letters denote limits of monthly rainfall and the subscript to a letter the number of months in which rainfall indicated by the letter is received. The limits chosen are the same as stated in paragraph 14.2.3 for different types of crops.

symbol	monthly rainfall@ cm
A +	greater than 30 cm
B	20-30
C	10-20
D*	5-10
E*	less than 5

The southwest monsoon months June to September form the principal rainy season and outside it there are hardly a few areas and months with rainfall of even 5 to 10 cm pm. In depicting therefore the year's distribution the portion for June to September is central and it is entered in brackets. To the right is the distribution for the post-monsoon months of October to January and to the left that for the pre-monsoon

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@ Overlapping interval points suitably adjusted.

* In distributions involving A or B types, rainfall amounts of less than 10 cm are less significant and their frequency is also small. To reduce the number of combinations, D type is skipped over in distributions beginning with A or B and E symbol denotes less than 10 cm pm. Thus B2 E2 would denote two months 20-30 cm pm and two months less than 10 cm pm.

+ An examination of monthly rainfall in the country shows that except for areas in the west coast, extreme north east and some hill areas, monthly rainfall seldom exceeds 40-50 cm.

months February to May. The number of possible combinations of months with different rainfall amounts and frequency for a four month period is 45. A list of these is given in ~~Statement I~~, Appendix 14.1 and these cover all the types and ranges of rainfall occurring in the different parts of the country in the southwest monsoon season. The year is divided into three periods of four months each. The arrangement of months in each of the four month periods is in the order of decreasing rainfall and not according to calendar sequence. However, no serious difficulty arises in general as the rainiest months in each season are well known e.g. July and August are usually the rainiest in June to September period. Similarly May is the rainiest month in the period February to May and October in October to January periods. To facilitate identification of rainfall of the different months, decoded form according to calendar sequence of each of the distributions occurring in the country have been suitably included and this coding sequence would therefore not offer any difficulty. An example of a yearly distribution is D1 E3 (A2 B1 C1) C1D3, in which for each of the three periods, the symbols are in order of decreasing rainfall which is not necessarily the calendar sequence. Its interpretation follows:

i) D1 E3 represents the period February to May in which one month's rainfall (usually May) belongs to 5-10 cm type and the remainder three months get less than 5 cm pm.

ii) A2 B1 C1 represents the period June to September, in which two months (usually July and August) get more than 30 cm pm, one month (September) belongs to 20-30 cm type and the remaining month i.e. June has 10-20 cm type.

iii) C1 D3 represents the period October to January in which October belongs to 10-20 cm type and the rest to 5-10 cm pm type.

14.2.5 If an identical distribution occurs over two or more adjacent taluks, the distribution is designated as a pattern and the area covered by it is distinguished as a zone and indicated suitably by numbers. Rainfall patterns have been identified for the whole country using the methodology described above. The data used for the analysis are the monthly normals of rainfall (1901 to 50) contained in Memoirs of India Meteorological Department Vol.XXXI - Part 3, 1962 and depicted on all-India map of scale 1 : 1 million. The terminology followed in describing and discussing distributions of monthly rainfall is as follows:

	terminology	description
i)	rainfall pattern	When a season's (four months) or the year's (12 months) distribution is referred to, according to context
ii)	type	When rainfall of any of the five intervals A to E is referred to e.g. A type, B type etc.
iii)	category	When a range between types is referred to e.g. A_1 to B_2 category

14.2.6 Boundaries of Rainfall Zones: Taluk is the unit of area in the present study and analysis but as rainfall is recorded at individual locations, we would have to consider the adequacy of a station (or stations) as representing the respective taluks in which it is (or they are) located. Although rainfall is a highly variable element, it is seen that differences in monthly, seasonal and annual amounts are small within short distances and the data of the taluk station could be used as representing rainfall of the taluk for all practical purposes. Being point measurements, isolines for the same or nearly the same type of distribution of monthly rainfall can be drawn. These isolines will not necessarily follow the boundaries of taluks but intersect them and the following procedure has been adopted for dealing with portions of taluks:

i) where variations are small, isolines follow the taluk boundaries;

ii) where essential, isolines intersecting taluk boundaries have been retained; and

iii) when listing taluks included in different rainfall zones, any area of less than a quarter of a taluk is omitted.

Cropping Patterns

14.2.7 The basic data for the study of cropping structure of the country is the area distributions of crops in the taluks. Numerous crops are grown in a taluk but most of them occupy a very small area as per cent of gross cropped area. For purposes of our study we have limited the crops in a taluk to those which individually occupy 10 per cent or more of the gross cropped area of the taluk and these are taken to constitute the crop distribution of the taluk. In this process, several crops have often got excluded, though they may be of local importance, e.g. vegetables, potato, tobacco, sugarcane, fruits etc. A minimum upper limit of the total areas of crops in a distribution or a pattern has been fixed at 70 per cent after several trial computations. The maximum number of crops needed to reach the minimum of seventy per cent area limit, seldom exceeds four or five. Also, it is only rarely that crops with more than 10 per cent area are omitted from inclusion in a cropping pattern. Thus, a combination of crops, each occupying not less than 10 per cent of the gross cropped area of the taluk and with a total of not less than

70 per cent of the gross cropped area of the taluk is considered as constituting a cropping pattern provided it is the same over two or more adjacent taluks.

14.2.8 As in the case of rainfall, crop areas are coded in terms of crop symbols with numerical subscripts to denote per cent areas covered. The code is as follows:

crop	code	crop	code
rice	Pd	groundnut	Gn
pulses other than pigeonpea and gram	Pu	oilseeds other than groundnut	O
potato	Pt	oats	Oa
Wheat	W	cotton	C
maize	M	other fibres	Fb
small millets	Mt	fodder	F
jowar kharif	Jk	fruits	Fr
jowar rabi	Jr	plantations	L
jute	Ju	sugarcane	S
bajra	B	vegetables	V
barley	Ba	chillies	Ch
ragi	R	pigeonpea(tur)	T
gram	G	tapioca	Ta

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area coverage* (per cent of gross cropped area)	Code
70 or more	1
50-70	2
30-50	3
10-30	4
less than 10	5

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* overlapping interval points suitably adjusted.

The code number indicating the percentage area coverage by a particular crop is affixed as a subscript to the crop symbol concerned. The first crop in a pattern has always the highest area among crops in the patterns and the rest do not necessarily follow the order of decreasing areas. For example crop pattern C3 Jr4 Mt4 indicates that cotton area is 30-50 per cent and jowar (rabi) and millets each occupy 10-30 per cent of the gross cropped area; the total is 70 per cent or more. The cropping patterns so derived have been indicated on maps of 1:1 million size and analysed.

Relative Yield Index (RYI) of Crops

14.2.9 The performance of crops in different parts of the country has been examined using the yield data of the respective crops. These are readily available in published form for districts and States only. Instead of using absolute yield values they have been expressed as per cent of all-India. The yield of a crop in a district expressed as percentage of all-India is called Relative Yield Index of the crop and denoted by symbol RYI. RYI values have been computed for the principal crops based on area and production statistics of districts for the three period, mostly 1968-69 to 1970-71. The three-year yield averages lend some stability to these figures and the years used were the latest at the time these were computed.

Livestock Patterns

14.2.10 The livestock patterns are relevant in the present context only in so far as these are related to production of fodder and feeds. Taluk data, which are the basis in this study for major components, have not become available from the

Livestock Census, 1972. Hence, data of 1966 Census as published by the States form the basis of computations. The categories of animals included in livestock census are shown below together with the symbols used in the present study:

category	symbol
cattle:	
males (over 3 years)	Cm
females (over 3 years)	Cf
young stock (under 3 years)	Cy
buffaloes:	
males (over 3 years)	Bm
females (over 3 years)	Bf
young stock (under 3 years)	By
sheep	S
goats	G
horses, mules and Ponies	H
donkeys	D
camels	Ca
pigs	P

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Following the same percentage intervals as used for crop patterns, the livestock patterns are identified and expressed in the following coded form.

percent of total livestock*	code
70 or more	1
50 - 70	2
30 - 50	3
10 - 30	4
less than 10	5

* overlapping interval points suitably adjusted.

Soils

14.2.11 Soil data corresponding to the scale used for the rainfall, crops and livestock patterns are not available for all the areas of the country. Out of about 305 Mha of the country's surveyable area, only about 90 Mha have been surveyed by one method or the other, but some of these areas need resurveying. In some states like Bihar and West Bengal, which have been covered almost entirely by reconnaisance survey, the work on soil correlation has not made much progress. Because of this position, we submitted an Interim Report specially on soil Survey and Soil Map of India (August, 1972) recommending that expeditious measures should be undertaken to prepare the soil map in 1: 1 M scale. We envisaged that a useful soil map of India could be prepared within about 10 years' time, if necessary steps to organise soil survey parties in accordance with specific requirements are commenced urgently. This being the position, it has not been possible to go into greater detail regarding soils than giving a broad description based on the information in the map prepared by the All-India Soil and Land Use Survey, Indian Agricultural Research Institute(1971).

Power

14.2.12 The components of power are human, animal (mainly bullocks and he-buffaloes), mechanical and electrical. Human power reckoned here comes from cultivators, agricultural labour and those engaged in livestock, forestry, fishery and plantation etc., as reported in the official census of 1971. Since district data from 1972 Livestock Census have become available and since it is sufficient for a broad idea of power availability in the present context, the same have been used for power study. Information on agricultural machinery has also been obtained from the same source. For estimation purposes, the contribution of each of the power components has been taken to be as follows:-

	component	horse power (HP) per unit
i)	human (for each person in the age group 15-59 years)	
	man	0.07
	woman	0.05
ii)	animals	
	bullocks/buffaloes	0.40
	camels	1.00
iii)	mechanical/electrical	
	tractors	25.00
	power tillers	7.00
	power sprayers/dusters	2.00
	diesel engines	7.00
	electric motors	6.00
	electrically operated sugarcane crushers	6.00

As tractors are also employed for hauling operations, only half of their number has been taken for calculating

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available power for tillage. Eighty per cent of human and animal power is taken as power available for crop production after allowing 20 per cent for extra farm activities. The reasons for these assumptions and detailed discussion of power availability have been given in Chapter 50 on Farm Power.

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3 GENERAL INFORMATION

14.3.1 This Section contains a brief analysis and description of certain determining & essential factors such as areas, human population, land use, irrigation, soils and livestock population which have a bearing on cropping patterns. Climatic factors including temperature, evaporation, sunshine and radiation and general rainfall distribution have been considered in the preceding Chapter.

Area

14.3.2 The geographical area of India is 328 Mha. As district and taluk data are used in the analysis, a brief indication is given of the distribution of their areas in the different States and the country. There were 356 districts in 1971,[1] and their areas are distributed as shown in Appendix 14.2 - Statement I. The districts are not of uniform size and vary widely from a few hundred sq km in the case of city/capital districts to more than 20 thousand sq km. About a quarter of the total number of districts have areas of less than 5 thousand sq km, 70 per cent of the districts have areas between 5 to 20 thousand sq km. The frequency of districts with area between 5 to 10 thousand sq km is 40 per cent. Of the 12 districts whose areas exceed 20 thousand sq km, 5 are in Rajasthan, one is Kutch in Gujarat and another is Bastar in Madhya Pradesh.

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[1] 1974. Indian Agriculture in Brief, Thirteenth Edition. New Delhi. Directorate of Economics and Statistics, Ministry of Agriculture and Irrigation, Government of India.

14.3.3 The taluk areas also vary widely. The total number of taluks in States where such a division of the district exists is about 1850.[1] In as many as 7 States of 14 listed in table 14.1, about 60 to 75 per cent of taluks exceed 1000 sq km in area. Even in a State of small area like Kerala 12 out of 57 taluks have areas higher than 1000 sq km. Areas of 40 per cent of the taluks in Madhya Pradesh are more than 2000 sq km each. Non-uniformity in areas of districts and taluks makes intercomparison of data difficult.

Table 14.1

Taluks/Tehsils exceeding 1000 sq km in Area

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State	Number of taluks/tehsils	Number with area of more than 1000 sq km	percentage of col.3 to col.2
1	2	3	4
Andhra Pradesh	195	139	71
Gujarat	184	53	29
Haryana	32	24	75
Himachal Pradesh	52	11	21
Karnataka	175	84	68
Kerala	57	12	21
Madhya Pradesh	190	169	89
Maharashtra	235	147	63
Orissa	103	61	59
Punjab	41	25	61
Rajasthan	196	113	58
Tamil Nadu	133	52	38
Uttar Pradesh	207	129	62
Jammu & Kashmir	44	9	20

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[1] Districts in Assam, West Bengal and Bihar are not divided into taluks.

Population

14.3.4 The total population of the country according to 1971 Census is 547.9 million corresponding to an average density for the country as a whole of 182 persons/sq km. The density, however, shows large variations when State, district and taluk areas are considered. Appendix 14.2 - Statement II shows the State density and frequency of district density in different intervals. Among the States, Kerala (549) and West Bengal(504) have the highest density of over 500 per sq km; Bihar, Tamil Nadu and Uttar Pradesh have density of about 300 per sq km; Uttar Pradesh density would be much higher, if the hill districts are excluded. Nagaland, Manipur and Arunachal Pradesh have low density of less than 50 per sq km but among the bigger States, Rajasthan has a low density of only 75 per sq km. The density of Jammu & Kashmir is vitiated due to lack of information on occupied areas. The district density shows large variations from less than 100 to over 1000 per sq km. Kerala and West Bengal are the only States with districts (which are not State capitals) which have density exceeding 1000 per sq km. Excluding Union Territories 20 per cent districts have density less than 100 per sq km, 40 per cent are between 100 and 200 per sq km and 30 per cent above 300 per sq km. Appendix 14.8 - Map VI shows the distribution of district density of population. The areas of low and high density are shaded. The belt of the country extending from West Uttar Pradesh to West Bengal (excluding hill areas and southern portions of Bihar) has density exceeding 300 per sq km. The only other continuous belt of high density is Kerala and neighbouring parts of Tamil Nadu.

14.3.5 For computing power availability for agriculture we need to know the agricultural[1] working population which is taken to include cultivators, agricultural labour and those engaged in livestock, fishery, forestry and allied activities. These categories total to 130 million but they cover all age groups up to 60 and above. Considering that effective work force engaged in agriculture is from 15 to 59 years, the agricultural workers for these age groups total to 109 million. This represents about 20 per cent of the population of the country. Corresponding figures for the different States are shown in Appendix 14.2 - Statement III and these vary between 15 and 25 per cent except for Nagaland Manipur (31 per cent) and Meghalaya (31 32 per cent). The maximum agricultural working population of 25 per cent is in Andhra Pradesh and Madhya Pradesh. Four States viz. Punjab, Haryana, West Bengal and Kerala have only 15 per cent. The frequency distribution of agricultural working population is as follows:

agricultural working population as per cent of total	number of States
14.5 - 15.0	4
15.1 - 20.0	5
20.1 - 25.0	10

14.3.6 The different items of land use have been expressed as percentages of the total reporting area. The reporting area increased gradually from 289.3 Mha in 1950-51 to 305.6 Mha in 1969-70 and 305.3 Mha in 1970-71. The area for which no returns exist as percentage of total geographical area is 6.7 per cent. Table 14.2 gives the all-India land use statistics for 1969-70 to 1971-72. It will be seen that of the total reporting area of about 306 Mha, forests occupy 21.6 per cent and land not available for cultivation about 15 per cent. Ten per cent of the area is barren and unculturable and area put to non-agricultural use is 5 per cent. Permanent pastures and other grazing lands, land under miscellaneous trees, crops and groves not included in net area sown and cultivable waste together account for 11 per cent. Current fallow lands are 4 per cent and other fallow lands account for 3 per cent of total reporting area. All these items total to about 55 per cent of reporting area. In 1969-70, net area sown was 45 per cent and in the subsequent two years 46 per cent. The cropping intensity is 118 per cent, area sown more than once being 18 per cent. Net irrigated area was 22-23 per cent of net sown area and gross irrigated area 23-24 per cent of gross cropped area during this period.

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[1] Census of India 1971, Series 1 - India, Economic Characteristics of Population.

Table 14.2

All-India Land Use Classification[1] - 1969-70 to 1971-72

Classification	per cent of reporting area		
	1969-70	1970-71	1971-72
area under forests	21.6	21.6	21.5
area not available for cultivation			
(i) area put to non-agricultural use	5.2	5.3	5.4
(ii) barren and uncultivable land	9.9	9.5	9.6
total (i & ii)	15.1	14.8	15.0
other uncultivated land excluding fallow land			
(i) permanent pastures and other grazing lands.	4.2	4.4	4.3
(ii) misc. trees, crops and grove not included in net area sown	1.5	1.4	1.4
(iii) culturable waste land	5.2	5.3	5.2
total (i + ii + iii)	10.9	11.1	10.9
fallow land			
(i) other than current fallows	3.1	2.8	2.9
(ii) current fallows	4.0	3.7	4.1
total (i + ii)	7.1	6.5	7.0
net area sown	45.3	46.0	45.6
total reporting area (thousand hectares)	306,050	305,270	305,583
total Geographical area (thousand hectares)	328,048	328,048	328,048
percentage of total cropped area to net area sown	118.1	117.6	117.7
percentage of area sown more than once to net area sown	18.1	17.6	17.7
percentage of net irrigated area to net area sown	21.9	22.3	22.7
percentage of gross irrigated area to gross cropped area	22.8	23.3	23.5

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[1] Indian Agriculture in brief 13th and 14th Editions, DES.

14.3.7 Appendix 14.2 - Statement IV shows the land utilisation statistics for 1969-70 for different States and Union Territories in the country. Some of the main features are briefly stated.

i) Forests: Andaman and Nicobar Islands are almost entirely under forests (94 per cent) closely followed by Arunachal Pradesh with 81 per cent. Around sixty per cent of the reporting area in Himachal Pradesh, Jammu & Kashmir, Tripura and Mizoram is under forests. Among the major States, Madhya Pradesh and Orissa have a third of their area under forests. In Kerala and Andhra Pradesh, a quarter of the total area is under forests. There are practically no forests in Punjab, Haryana and Rajasthan. In the rest of the major States forests account for ten to twenty per cent of the reporting area.

ii) Land not available for cultivation is generally 10 to 20 per cent. However, 33 per cent of land in Assam, 26 per cent in Gujarat and 60 to 85 per cent in Manipur, Meghalaya and Nagaland is not available for cultivation.

iii) Fallow lands are generally less than 10 per cent and in some States practically negligible. Only Bihar, Rajasthan and Tamil Nadu have 12 to 16 per cent area under fallow lands.

iv) Net sown area is highest, 80 per cent of reporting area, in Haryana and Punjab. It is around 40 per cent in the belt from Rajasthan to Orissa and Andhra Pradesh and 50 to 60 per cent in the west and south from Gujarat to Kerala and Tamil Nadu. In Assam and Tripura net area sown is around 30 and 20 per cent respectively while in Himachal Pradesh and Jammu & Kashmir it is around 10 and 15 per cent respectively. In Manipur net area sown forms only eight per cent of the reporting area and negligible in the north eastern States.

v) Area sown more than once as per cent of net sown area is highest (68 per cent) in Himachal Pradesh and 30 to 40 per cent in the tract from Punjab to West Bengal and Orissa, Tripura and Kerala and 15 to 25 per cent in Jammu & Kashmir, Meghalaya, Andhra Pradesh and Tamil Nadu; elsewhere, it is small 5 to 10 per cent. The intensity of cropping is not high, particularly in the South.

Irrigation

14.3.8 The net and gross irrigated areas during the two decades from 1950-51 are shown in Table 14.3. Net irrigated area rose by fifty per cent, though during the last three years, the rise has been small. The increase in gross irrigated area has been larger, seventy per cent. According to estimate for 2000 AD given in Appendix 15.2 of Chapter 15 on Irrigation, the gross irrigated area during the next three decades will be more than doubled.

Table 14.3
Irrigated Area

(Mha)

Year	Net	Gross
1950-51	20.9	22.6
1955-56	22.8	25.6
1960-61	24.7	28.0
1965-66	26.3	30.9
1969-70	30.4	37.3
1970-71	31.2	38.5
1971-72(provisional)	31.6	38.6

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According to estimate for 2000 AD gross irrigated and cropped areas are expected to be 84 Mha and 200 Mha respectively. This would correspond to a gross irrigated area of 42 per cent, leaving still about 60 per cent to be fed by direct rainfall. Rainfed agriculture would continue to dominate Indian agriculture, almost as a permanent feature. The distribution of gross irrigated areas/ - Appendix 14.2 Statement - IV shows wide variations among the States, being less than 10 per cent in Madhya Pradesh and Maharashtra (two of the biggest States in the country), to about 75 per cent in Punjab which is the State with highest percentage of irrigation in the country. Haryana and Tamil Nadu are next with around 45 per cent but 30 per cent less than Punjab. Andhra Pradesh and Uttar Pradesh are about a third irrigated. Bihar, West Bengal, Assam and Kerala have 20 to 25 per cent irrigation and elsewhere it is 10 to 20 per cent. Appendix 14.2 - Statement V shows the frequency of districts in each State in different class intervals of net irrigated area. Of the 302 districts for which data could be collected, only 40 (13 per cent) have more than 50 per cent irrigation. A third of the districts had less than ten per cent. About 20 per cent of the districts had 30 to 50 per cent net irrigated area.

14.3.9 The distribution of irrigated area under various sources is shown in Appendix 14.2 - Statement VI. For the country as a whole, 40 per cent of the net irrigated area is under canals, 38 per cent under wells and 15 per cent under tanks. The State figures show significant variations. Canal irrigation accounts for nearly half the net irrigated area in Madhya Pradesh, Andhra Pradesh, Kerala and Punjab, around 60 per cent in Haryana and Assam and more than 95 per cent in Jammu & Kashmir. In Karnataka, Tamil Nadu, Rajasthan, Uttar Pradesh and Bihar around 35 per cent area is irrigated by canals. A feature of significance is that in Uttar Pradesh, Maharashtra, Gujarat, Rajasthan and Punjab well irrigation accounts for more than 50 per cent of irrigated area. In Tamil Nadu, Bihar and Karnataka it is 20-30 per cent only. Elsewhere well irrigation is small or negligible. The highest percentage of tank irrigation is in Orissa being 51 per cent, and accounts

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for a third in Tamil Nadu, Karnataka and Andhra Pradesh. Tank irrigation accounts for 10-20 per cent in Rajasthan, Maharashtra, Kerala and West Bengal; elsewhere it is negligible. Net irrigated area as per cent of net sown area of districts is shown in Appendix 14.8 - Map VII which relates to the year 1970-71 for a number of areas and to 1969-70 for the rest.

Soils

14.3.10 As already mentioned in Section 2, information on soils is scanty. We give here a brief idea of the main types of soils prevailing in the different parts of the country. This account is based on the Soil Map of India, published in 1972 by IARI which is on a scale of 1 cm = 60 Km. For more details, reference may be made to Soils of India[1] a compilation by the Fertiliser Association of India for the different States of the country. The account which follows is given for areas in latitudinal intervals.

i) Latitudes south of 16°N:

The areas covered are Tamil Nadu, Kerala, most Karnataka and southern parts of Andhra Pradesh. Excluding coastal areas, the main soils in the rest of the portion are red sandy with pockets of mixed red and black, red loam and laterite. A wide laterite belt runs along the west coast from northwest to southeast and immediately adjoining area in the east has red loam soils. East coast like the west has a narrow or thin strip of coastal alluvium with deltaic alluvium in Tanjore area and pockets of red loam and lateritic soils.

ii) Latitudes 16 to 20°N:

Along west coast southern half is laterite and northern red loam. In the east, coastal alluviu and in Krishna and Godavari areas deltaic alluvi are present. Of the remaining area, half of it the west has black soils mostly medium deep and in the east red sandy with sizeable pockets of deep black and red loam soils.

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[1] 1972. Soils of India, New Delhi. The Fertiliser Association of India.

iii) Latitudes 20 to 24^{0}N:

The areas covered extends from Saurashtra and Kutch in the west to Tripura and Mizoram in the east. Almost the entire area to the west of longitude 80^{0}E is covered by black soils with pockets in Gujarat of calcareous soils and delataic alluvium in Kutch. East of longitude 80^{0}E, the soils are red and yellow except for pockets of laterite, red sandy and laterite soils; the areas of West Bengal are mostly alluvial.

iv) Latitudes 24 to 32^{0}N:

(a) West of longitude 76^{0}E, the areas covered are Rajasthan and western portions of Haryana and Punjab. Soils in these areas are desert, calcareous, old alluvial in parts of Ganganagar and Ferozepur, alluvial with salinity in Tonk and Jaipur and in Amritsar to Jullundur. It should be mentioned that a fairly wide belt of calcereous soils runs from latitude 22^{0} in Surendranagar and Mehsana districts to Hissar and Ferozepur districts. The Southeastern part has red brown, mixed red and black and alluvial with salinity soils.

(b) East of longitude 76^{0}E:

South of line from Jaipur to Gaya and then to West Dinajpur (West Bengal) soils are moderate black, mixed red and black or red sandy in the western half and red and yellow with small area of red sandy up to West Bengal (longitude 88^{0}E). Excluding hilly areas both to the north and east, the rest of the area is mainly alluvial with saline patches.

v) Latitudes North of 32^{0}N:

In the extreme north there are glaciers and permanent snow, mountain meadow sub-montane and brown silt soils.

vi) General:

Alluvial soils occupy about 30 per cent of the geographical area of the country. Alluvial soils calcareous, coastal alluvium, deltaic alluvium and alluvial soils affected by salinity and alkalinity occupy 12 per cent. Desert soils are 4 per cent in area, black soils 15 per cent and red soils 9 per cent. All these types total to about 70 per cent of the geographical area.

Livestock

14.3.11 The total livestock population of the country rose from 307 million in 1956 to 336 in 1961, 344 in 1966 and 355 million in 1972. The total rise during the last decade has been of the order of 6 per cent. Cattle constitute the largest in numbers, being half the total number of livestock. Among cattle, males of over three years are larger in number than the rest, the approximate distribution being Cm 21 per cent, Cf 16 per cent and Cy 14 per cent of total livestock population. This percentage distribution has remained practically the same from 1951. Goats are 19 per cent and sheep 11 per cent. Together, cattle, goats and sheep account for over 80 per cent of the total livestock in the country. Camels and horses are the lowest in numbers, being only 0.3 per cent of the total. Pigs constitute nearly 2 per cent. The total number of buffaloes is not insignificant, being more than ten per cent. The males, females and youngstock individually constitute less than 10 per cent of the total livestock and, therefore, do not figure in the livestock patterns in general. Sheep form the predominant category in Andhra Pradesh, Tamil Nadu and Karnataka in the south and in Himachal Pradesh and Jammu & Kashmir in the north. In Rajasthan sheep are next to goats but are in substantial numbers being over 20 per cent of the total. The belt from Maharashtra to Uttar Pradesh in the north and Assam in the east has generally Cm as the largest category. Goats assume this position in Kerala, Rajasthan, Gujarat and West Bengal. In West Bengal and Bihar both male cattle and goats have nearly equal numbers. It is of interest to mention that goats are the largest category in Kerala with 30 per cent of total; female cattle are also high in numbers with 26 per cent closely followed by young stock with 24 per cent of total. Gujarat too is similar with G and Cm having nearly equal percentages. Punjab and Haryana have Bf as the largest category. Bf account for more than 10 per cent in Uttar Pradesh, Gujarat and Andhra Pradesh. In the eastern States pigs are important. In Nagaland they are more than 50 per cent of total livestock. In Manipur they are slightly higher than Cm. In Goa, Deman and Diu they are nearly of the same order as male cattle. The other categories are mostly negligible in numbers. A few other points are:

i) Cm is not less than 10 per cent of total livestock in any State except Kerala and Nagaland. The highest proportion is in Uttar Pradesh (28 per cent) followed by West Bengal, Assam, Orissa, Madhya Pradesh and Maharashtra with about 25 per cent each. Elsewhere it is ~~mostly~~ between 15 to 20 per cent.

ii) Cf varies between 10 to 25 per cent and the maximum is in Madhya Pradesh, Orissa, Kerala and Assam. Cy is lower and ranges between 10 to 20 per cent.

iii) Bf accounts for about 20 per cent in Haryana and Punjab and 10 to 15 per cent in Gujarat and Andhra Pradesh. By category is highest in Punjab and Haryana (19 per cent) and less than 10 per cent elsewhere. In West Bengal it is hardly 1 per cent.

iv) Sheep in Tamil Nadu, Andhra Pradesh, Karnataka, Jammu & Kashmir and Himachal Pradesh are 21 to 25 per cent. In the very heavy rainfall States of Kerala and Assam they are almost absent.

v) Goats are about 30 per cent in Kerala and Rajasthan.

vi) Even in Rajasthan, Punjab and Haryana, camels hardly form 2 per cent.

vii) The percentage of pigs is maximum in the eastern States and Andaman and Nicobar Islands. In Goa, it is about 20 per cent.

Appendix 14.3 - Statement # I shows the different livestock categories in each of the States as percentages of their respective totals in 1966 and 1972 censuses.

14.3.12 The livestock patterns in the States have been analysed using taluk data except in the case of Kerala and a few eastern

States for which district/sub-divisional data have been utilised. The patterns are listed in Appendix 14.3 - Statement II. As may be expected in examining smaller areas, the variations from the main patterns for the State as a whole, would often be considerable. As an example, Kerala's main pattern begins with G but more detailed analysis shows that there are significant areas where Cf predominate There are very few patterns which begin with a subscript 3 and of 2 there are extremely few. The predominance of sheep and cattle (male) in the southern States excluding coastal areas may be noted.

14.3.13 A number of patterns are common in different States. In drawing up the livestock patterns for the whole country, patterns which are common to two or more States will appear only once. Also, to show the broad features of livestock distributions in the country, patterns with two or three common categories are grouped together and the remainder categories shown as alternates by oblique lines. The total number of patterns drawn up in this manner for the whole country is thirty five (35) and these are listed in Appendix 14.3 .Statement III . They are distributed according to category and numerical subscript as follows:

pattern beginning with	subscript 1	2	3	4	total
Cm			3	4	7
Cf			2	3	5
Cy			1	1	2
Bf			1	4	5
G			2	3	5
S	1	1	2	3	7
P	1	1	1	1	4

Male cattle have not exceeded 50 per cent of total livestock population of any taluk/district in the country. In two patterns with S and P, the percentage is above 50 and in one about 70 or higher. The number of patterns in the country is small and is suggestive of uniformity in distribution over large areas.

14.3.14 The livestock patterns in the different parts of the country are shown in Appendix 14.8 (Map V).

4 RAINFALL PATTERNS - ZONES

14.4.1 The rainfall distributions of individual stations have been analysed in the manner explained in Section 2 above. In many cases, each taluk has only one station and linear interpolation and simple permissible approximations have also been employed while analysing the distributions. All taluks with identical distributions have been grouped together and the patterns drawn up for each State separately. In writing the annual rainfall distributions, the arrangement in each four month period is according to decreasing class interval and not according to calendar sequence of months. To get over this, decoded form of rainfall patterns and their equivalents have also been given according to calendar months. Additional information on (i) frequency of months with rainfall greater than 10, 20 and 30 cm per month, (ii) geographical area expressed as per cent of State area and (iii) gross cropped area as per cent of total cropped area of the State has also been included. These are given in Appendix 14.4 (Statement I). The advantage of presentation in this form is that one will know at a glance the rainfall in each month and the number of consecutive months with different amounts of rainfall which is essential for crop analysis. The area covered by each pattern is a zone and the zones are numbered in each State according to increasing rainfall intervals. Basic information on annual rainfall, month of maximum rainfall, rainfall total of month of maximum and preceding or following whichever is higher and number of months with 10 cmpm or more and total of rainfall for these months are included for each taluk station in an appendix to the State Reports.

Zonal Areas

14.4.2 The areas under each of the patterns (zones) for the periods June to September, February to May and October to January have been worked out for each of the States separately and for the country* as a whole. These are contained in Appendix 14.4 Statements II to IV. Salient features are discussed below:

i) February-May: 72 per cent of country's geographical(reporting area gets rainfall of less than 5 cm pm and 15 per cent area has 5-10 cm mostly during May. The main feature of this period is thus that about 90 per cent of the geographical area of the country does not have even one month of 10 cm or more of rainfall i.e., C type during February to May. The higher types are confined to Assam, West Bengal, Kerala and to some extent to Tamil Nadu, Karnataka, Himachal Pradesh and Jammu and Kashmir.

ii) In June to September the principal rainy season, areas of patterns/types vary widely. A4/A3 types cover a total area of 7 per cent. A2 B2 has the largest area of 12 per cent and A2 B1 C1 8 per cent. A2 types are the largest with 26 per cent of total geographical area and all A types together occupy 41 per cent area. B areas are less. B2 type covers 11~~2~~ per cent and all B types together 22 per cent. C is more than B, with a total area of 29 per cent. C4/C3 area is 9 per cent and C2 about ~~8~~11 per cent. D area is about 7 per cent. E is almost negligible with only 0.6 per cent area. The areas of SW monsoon patterns beginning with types A,B,C and D and exceeding one per cent are distributed as follows:

Per cent area	A	B	C	D
1.01 - 2.00	2	2	1	
2.01 - 5.00	5	3	2	
5.01 - 10.00	1	2	4	1
10.01 - 13.00	1			

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* The total for the country given in Appendix 14.4 Statements II to IV does not include areas of the northeastern States/Territories and occupied areas, due to want of necessary rainfall data etc. This, however, is not likely to affect significantly the major rainfall zonal or pattern areas. The geographical area considered for these statements is the reporting area as received from the States.

iii) During October to January 45 per cent area is under E type, i.e. no month has even 5 cm of rainfall. Thirty per cent of the area mostly from Assam to Uttar Pradesh and in the southern States gets 5-10 cm during October. Fifteen per cent is in 10-20 cm pm class and this covers the east coast belt up to Bengal and areas in north eastern States.

14.4.3 Gross Cropped Area: Appendix 14.4 Statement V shows the gross cropped area in 1969-70 in each State for each of the rainfall patterns of the South-west monsoon. A4/A3 covers only 5 per cent of gross cropped area, but A2 is nearly a quarter (24 per cent) and A1 nearly 9 per cent. B2 types are 13 per cent and B1 9 per cent. C4/C3 is 12 per cent and C2 areas total to another 12 per cent. All these add up to about 84 per cent.

All India Rainfall Patterns

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14.4.4 The four monsoon months constitute the dominant rainfall period in the country. During these four months, the patterns in different areas may vary from A to E type. When one considers the rainfall in the preceding four months and also that in the succeeding four months, the patterns are considerably large in number. Even in type A, there can be rainfall of that magnitude in all the four months or in three, two or one month. Thus under type A itself, there would be 13 patterns if monsoon months alone are considered. But when the patterns of rainfall in the preceding four months as also in the succeeding four months are considered, the number of patterns under Type A becomes 73. Likewise, with monsoon season type B, the total number of patterns would be 31, while it would be 49 with type C, 15 with type D and 6 with type E. This makes a total of 174 patterns as shown below:

type	no. of patterns
A	73
B	31
C	49
D	15
E	6
	174

The Statewise break-up of number of patterns considering the entire year and on the basis of monsoon types A to E is shown in Table 14.4. It is to be noted that some of the patterns are common to more than one State. The number of common patterns and the total net patterns are shown in the last two columns of the table. The complete list* of patterns with all-India Zone number is given in Appendix 14.4 Statement VI .

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* Due to paucity or absence of rainfall data, patterns do not cover most of the North Eastern States/Territory hill areas and some of the other Union Territories; in most of the cases areas are also not large.

Table 14.4

Number of Rainfall Patterns in each State and all-India

Southwest monsoon pattern	Assam	West Bengal	Orissa	Bihar	Uttar Pradesh	Himachal Pradesh	Jammu & Kashmir	Punjab	Haryana	Rajasthan	Gujarat	Madhya Pradesh	Maharashtra	Andhra Pradesh	Karnataka	Tamil Nadu	Kerala	Total all States	Number common in two or more States	Total excluding common patterns
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A4	7	2		1									1		4	1		16	2	14
A3 B1	3		1	1							1		1		2	1	2	12	2	10
A3 C1													1		3		1	5	1	4
A2 B2	1	2	5	3							1	1	1	1				15	8	7
A2 B1 C1	2	1		3	2	3					1	2	1	1	1		1	18	8	10
A2 C2					1	2						2						5	1	4
A2 C1 E1					1	1	3	1		1		1						8	4	4
A1 B3	1		1															2	-	2
A1 B2 C1	2			3	1													6	1	5
A1 B1 C1 E1				1	2					1	1	1						6	3	3
A1 B1 C2				3	1						1	2	2	2	1		1	13	7	6
A1 B1 E2										1								1	-	1
A1 C3	1										1		1					3	-	3
total																				73

Table 14.4 (contd.)

Southwest monsoon pattern	Assam	West Bengal	Orissa	Bihar	Uttar Pradesh	Himachal Pradesh	Jammu & Kashmir	Punjab	Haryana	Rajasthan	Gujarat	Madhya Pradesh	Maharashtra	Andhra Pradesh	Karnataka	Tamil Nadu	Kerala	Total all States	Number common in two or more States	Total excluding common patterns
B4			2															2	-	2
B3 C1		1	2		2									2				7	1	6
B1 C2 E1					1	3		1			1							6	2	5
B2 C1 E1					1	2	2	1	1	1		1						9	4	5
B2 E2							1			1	1							3	1	2
B1 C1 E2	1									1	1					1		4	2	1
B1 C3	1											1	2	3	1	1	1	10	4	6
B2 C2				3	1						1	1	1	1			1	9	5	4
total																				31

Table 14.4 (contd.)

Southwest monsoon pattern	Assam	West Bengal	Orissa	Bihar	Uttar Pradesh	Himachal Pradesh	Jammu & Kashmir	Punjab	Haryana	Rajasthan	Gujarat	Madhya Pradesh	Maharashtra	Andhra Pradesh	Karnataka	Tamil Nadu	Kerala	Total all States	Number common in the or more States	Total excluding common pattern
C1 D1 E2										1	1			1	1	3		7	2	5
C1 D2 E1														4		1		5	1	4
C1 D3											1		1	5	4	2		13	3	10
C2 D1 E1								1	1	1	1					4		8	3	5
C2 D2						2	1			1	1		1	4	3	6		19	6	13
C3 E1					1													1	-	1
C3 D1					1			1	1	1			1	3	2			10	5	5
C4				1							1		2	3	1	2		10	4	6
total																				49
D1 E3							1									1		2	-	2
D2 E2							1	1		1					2	4		9	1	8
D4							1											1	-	1
D3 E1						1	1	1	1					1				5	1	4
E4						2	1									3		6	-	6
total																				21

14.4.5 Rainfall maps: The rainfall patterns depict the distribution of monthly rainfall in coded form for the entire year. These are shown in Appendix 14.8, Map I. The decoded version of the patterns are given in the respective State tables in Appendix 14.4 .Statement I .

14.4.6 A knowledge of the month of maximum rainfall (M) together with (a) totals of rainfall (Rf) and rainy days (Rd) of two consecutive months - month of maximum and of preceding or following whichever is higher and (b) the number of consecutive months (n) with month of commencement(m) and totals of rainfall (Rf) and rainy days (Rd) of these months, is helpful for an understanding of the cropping patterns, etc. These items of information are given for the taluks in the country as far as available in the respective State reports and are also shown in Appendix 14.8.(Map II).

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5 RAINFALL REGIONS

14.5.1 The number of rainfall zones into which the country is divided is 174. This number may not seem large for a country of India's size but for convenience in handling and bringing out clearly areas with different number of consecutive months of 10-20 cm pm, 20-30 cm pm and 30 cm pm or more, the various zones have been grouped into bigger units and designated as 'Regions' by introducing two simple modifications in the rainfall code used earlier for drawing up the rainfall patterns. The first is to combine Classes D and E for reasons mentioned below and replace them by only one symbol E to denote rainfall of less than 10 cm. In connection with general limits of rainfall for different types of crops it has been indicated that rainfall of 5-10 cm per month for not less than three consecutive months would be helpful for crops which are low water requiring like moth, ephemeral grasses etc. It should, however, be remarked that for satisfactory growth of crops, rainfall should be closer to 10 cm per month for at least three consecutive months. From this point of view, keeping a class of 5-10 cm per month may not be satisfactory. While information on this is available in the detailed rainfall patterns of the different States, in the case of Regions the limit of 5-10 cm pm is not shown separately but is combined in class less than 10 cm pm, denoting this by symbol E. Thus, there will be only four classes in describing the patterns of distribution of the rainfall of Regions: A, B, C and E; A,B and C have the same meanings as before. If in a distribution of four months, two or three months are of one class (say B) and one a stage higher (A), the distribution is shown as belonging to the same class B for not less than three consecutive months and written as (B4/B3). For example, A4, A3 B1, A3 C1 and A3 E1 are comabined and shown as Jn (A4/A3) to indicate that there are not less than three consecutive months of A type during June to September. Similarly, distributions A1 B3, A1 B2 C1, A1 B2 E1, B4, B3 C1 and B3 E1 are combined and written as Jn (B4/B3) and B1 C3, B1 C2 E1, C3 E1 and C4 as Jn (C4/C3).

14.5.2 Using the above simplifactions, the number of rainfall patterns is only 62. The area covered by each of these Rinfall Patterns (which includes one or more of the corresponding zones) is termed a Region. The country is thus divided into 62 Rainfall Regions and numbered 1 to 62. A few hill areas in the extreme east, Nagaland, Manipur, Arunachal Pradesh, Nilgiris and West Uttar Pradesh hills are not shown as data for these areas are extremely sparse or absent. Rainfall Patterns for these areas on the basis of available data have been shown separately earlier and could be referred to as needed. It is similar for Andamans and Nicobars and Laksha Dweep group of islands. The 62 Rainfall Regions are shown in Appendix 14.10 (Map III).

14.5.3 Region I covers areas which do not get in any month even 10 cm rainfall. Regions 2 to 17 include areas with one or more months during June to September of C type rainfal or higher and these are listed in increasing order of rainfal distribution. Regions 18 to 22 have rainfall of 10 cm or more cm for one or more months beginning with October. The other regions 23 to 62 are arranged in increasing order of rainfall. Two statements showing list of regions together with relevant particulars on rainfall patterns, actual geographical and gross cropped areas with percentages to all-India, number of taluks in each Region and their location in States; are detailed in Appendix 14.5 Statements I and II Some of the main features of the Regions are discussed below:-

i) Regions 1 to 17 cover about three-fourths of the geographical (74.5%) as well as gross cropped areas (77.9%) of the country. Region 1 has a gross cropped area of 2.7 per cent of the total. The areas of these Regions extend from parts of West Bengal to Jammu & Kashmir, Punjab, Rajasthan, Madhya Pradesh, Gujarat, Maharashtra, Karnataka and Andhra Pradesh.

ii) Region 18 is small and covers a few taluks only, two in Karnataka and four in Himachal Pradesh. This is the only Region where rainfall of 10-20 cm is confined only to October. Region 2 whose cropped area is 5 per cent of total has also only one month of 10-20 cm but this is July in northern areas and September in the Peninsula. Regions 19 to 31 cover areas in the South Peninsula reaching southern portions of Orissa. C or higher type of rainfall is for 2 to 3 months from October in Regions 19 to 22, from September for 2 to 4 months in Regions 23 to 26 and for four months from August in Regions 27 to 29. In Regions 30 to 36, rainfall of C or higher type is mostly from June (in a few cases from July) for four or five months. In Regions 55 to 62 which cover mainly Assam and Kerala, rainfall of C or higher type is for 7 to 8 months from May, April or March. In Regions 38 to 40, 43, 46 and 50-53 there are two different periods during which rainfall is of C or higher class.

iii) For study of crop structure, it is necessary to have for ready reference the distribution of rainfall according to calendar months. The coded form in Appendix 14.5 Statement I would not immediately meet this need. Besides, it is also necessary to know the month of commencement and number of consecutive months with rainfall in different class intervals. Such information is contained in the rainfall pattern lists given in Appendix 14.5 - Statement II, but is not easy for frequent handling. For this reason, the rainfall distributions of the various Regions arranged according to calendar months are given below in (iv).

(iv) Rainfall Regions are arranged in eleven groups (I to XI) according to month of commencement of rainfall of 10 cm pm or higher and distributions of rainfall are shown in sequence of calendar months with following symbols:

Ja	January	Jl	July
F	February	Au	August
Ma	March	S	September
Ap	April	O	October
My	May	N	November
Jn	June	D	December

Group no.	Rainfall Region	Rainfall pattern		Gross cropped area (per cent of all-India)
I	1	no month with 10 cm or more		2.73
II	fainfall of 10 cm pm or more for one or two months during June to September only.		no. of consecutive months	
	2	Ji/S C1	1	5.04
	3	Ji/Au C2	1-2	8.94
	5	Ji B1 C1	2	1.87
	6	Ji B2	2	0.92
III	rainfall of 10 cm pm or more for three or four months during June to September only.		no. of consecutive months.	
	4	Jn (C4/C3)	4/3	16.90
	7	Ji B2 C1	3	8.72
	8	Jn C1 B2 C1	4	3.33
	9	Jn (B4/B3)	4/3	2.53
	10	Jn (C1 A1 C2)	4	0.39
	11	Ji (A1 B1 C1)	3	1.39
	12	Jn (C1 A1 B1 C1)	4	4.07
	13	Ji (A2 C1)	3	2.44
	14	Jn C1 A2 C1	4	3.50
	15	Jn C1 A2 B1	4	7.57
	16	Jn B1 A2 B1	4	7.15
	17	Jn (A4/A3)	4	0.18
IV	October			
	18	O C1	1	0.09
	19	O C2	2	1.34
	20	O C1 B1 C1	3	0.12
	21	O B2 C1	3	0.14
	22	O B1 A1 B1	3	0.08

Group no.	Region no.	Rainfall pattern	Number of consecutive months	Gross cropped area per cent of all-India
V	September			
	23	S C2	2	0.98
	24	S C3	3	0.93
	25	S C1 B2	3	0.10
	26	S C1 B1 A1 C1	4	0.17
VI	August			
	27	Au C4	4	1.86
	28	Au C3 B1 C1	5	0.67
	29	Au C2 B1 A1 C1	6	0.20
VII	June Five months from June or four from July (October 10-20 cm)			
	30	Jn (C4/C3) OC1	4/5	2.60
	31	Jn (B4/B3) OC1	4/5	0.88
	32	Jn C1 A1 C3	5	0.17
	33	Jn C1 A1 B1 C2	5	0.10
	34	Jn C1 A2 B1 C1	5	0.05
	35	Jn B1 A2 B1 C1	5	0.89
	36	Jn (A4/A3) OC1	5	0.71
VIII	May - 5 to 7 consecutive months			
	37	My C1 Jn (A4/A3)	5	0.26
	41	My C2 B1 C3	6	0.03
	42	My C1 B1 A1 B1 C2	6	0.02
	44	My C1 B1 A2 B1 C1	6	2.59
	45	My C1 Jn (A4/A3) OC1	6	0.23
	47	My C2 B1 C2 B2	7	0.04
	48	My C1 B3 C1	5	1.37
	49	My C1 Jn (A4/A3) OB1 C1	7	0.27
	55	My B1 Jn(A4/A3) OB1 C1	7	0.77
IX	April/March 6 to 8 consecutive months			
	56	Ap C1 B1 A1 B1 C2 B1 C1	8	0.12
	57	Ap C1 B1 C1 A2 B1	6	0.20
	58	Ap C1 B1 Jn (A4/A3) OC1	7	0.66
	59	Ap C1 B1 Jn(A4/A3) OA1B1	8	0.59
	60	Ap C1 A1 Jn(A4/A3) OC1	7	1.14
	61	Ma C1 B1 A1 B1 A1 B1 A1 B2 C1	8	0.23
	62	Ma C1 A1 Jn(A4) OC1	8	0.23

Group no.	Region no.	Rainfall pattern	Number of consecutive months	Gross cropped area per cent of all-India
X	Two Seasons			
	38	My C1 - O C1		0.08
	39	My C1 - S C2		0.65
	40	My C1 - Au C3		0.50
	43	Ja C2 -J1 A2 C1		0.04
	46	Ja C2 - J1 B1 C2		0.02
	50	Ja C3 - J1 C2		0.05
	51	Ja C3 - J1 B2 C1		0.02
	52	Ja C3 - J1 A2 C1		0.03
	53	Ja C3 - Jn C1 A2 B1 C1		0.07
XI	54	Ja C4		0.12

(v) Regions which have the same class or type of rainfall for 3 or 4 consecutive months during June to September.

Region no	Rainfall pattern	gross cropped area (per cent of all-India)	States
Jn (C4/C3)			
4	Jn(C4/C3)	16.8	Himachal Prades Punjab, Haryana, Rajasthan, Utta Pradesh, Madhya Pradesh, Gujara Maharashtra, Karnataka, Andhra Pradesh.
30	Jn (C4/C3) OC1	2.6	Andhra Pradesh, Karnataka, Oris Himachal Prades
	Total for Jn (C4/C3)	19.4	
Jn (B4/B3)			
9	Jn (B4/B3)	2.5	Andhra Pradesh, Uttar Pradesh, Bihar.
31	Jn (B4/B3) OC1	0.88	Andhra Pradesh, Orissa.
42	My C1 Jn(B4/B3) C1	0.02	Assam
48	My C1 Jn(B4/B3)	1.38	West Bengal

Region no.	Rainfall pattern	gross cropped area (per cent of all-India)	States
61	Ma C1 B1 A1 Jn(B4/B3)OC1	0.02	Assam, West Bengal
Total for Jan (B4/B3)		4.8	
Jan (A4/A3)			
17	Jn (A4/A3)	0.2	Gujarat, Maharashtra
36	Jan (A4/A3) OC1	0.75	Karnataka, Maharashtra, Orissa.
37	My C1 Jn (A4/A3)	0.26	Bihar
45	My C1 Jn(A4/A3) Oc1	0.23	Karnataka
49	My C1 Jn (A4/A4) OB1C1	0.27	Karnataka, Kerala.
55	My B1 Jn(A4/A3)	0.75	Kerala
58	AP C1 B1 Jn(A4/A3) OA1B1	0.60	Kerala
59	AP C1 B1 Jn (A4/A3) OC1	0.67	Assam, West Bengal
60	AP C1 A1 Jn (A4/A3)OC1	1.14	Assam, West Bengal
62	Ma C1 A2 Jn(A4/A3) OC1	0.23	Assam
Total Jn (A4/A3)		5.1	

14.5.4 The total cropped area under Jn (C4/C3), Jn (B4/B3) and Jn (A4/A3) is 29.3 per cent of the gross cropped area of the country. It may be seen that Jn(A4/A3) patterns which number ten are having areas only in Kerala, Karnataka, Maharashtra, Gujarat (all in the West Coast and neighbourhood) and in Assam and Sub-Himalayan West Bengal areas; these account for only 5.1 per cent of the cropped area of the country. Jn (B4/B3) patterns cover areas in Assam, West Bengal, Andhra Pradesh, Bihar, Uttar Pradesh and Orissa and their total area is 4.8 per cent.

In (C4/C3) has only two patterns but covers a vast area, 19.4 per cent of the gross cropped area of the country.

14.5.5 Map of Rainfall Regions: Appendix 14.8 (Map III) shows the rainfall Regions of the country. The rainfall pattern of each of the Regions is also entered in the Map.

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6 CROPPING PATTERNS

14.6.1 The areas under different crops during the two decades from 1950-51 to 1970-71 are shown in table 14.5:

Table 14.5:

All-India Areas under Principal Crops as per cent of Gross Total Cropped Area

Crops	1950-51	1955-56	1960-61	1965-66	1968-69	1969-70	1970-71
rice	23.6	21.5	22.3	22.8	22.5	22.8	22.3
wheat	7.6	8.6	8.5	8.1	9.8	10.2	10.8
jowar	11.8	11.8	12.1	11.3	11.0	10.4	10.2
all cereals	61.1	59.5	60.2	59.3	61.0	61.0	60.7
gram	5.9	6.7	6.1	5.2	4.2	4.7	4.7
all pulses	15.6	16.0	15.5	14.7	13.7	14.0	13.7
total foodgrains	76.7	75.5	75.7	74.0	74.7	75.0	74.4
sugarcane	1.5	1.3	1.6	1.3	1.6	1.7	1.6
condiments and spices	0.9	1.0	1.0	1.0	1.0	1.0	1.1
fruits	0.5	0.6	0.7	0.9	0.9	0.8	0.9
potatoes	0.1	0.2	0.2	0.3	0.3	0.3	0.3
vegetables	1.1	0.9	1.0	1.2	1.4	1.3	1.3
groundnut	3.3	3.6	4.2	5.0	4.6	4.3	4.5
total oilseeds	8.3	8.1	8.4	9.1	8.7	8.4	8.8
cotton	4.3	5.7	5.0	5.1	4.7	4.8	4.7
jute	0.4	0.5	0.4	0.5	0.3	0.5	0.4
other crops	6.3	6.4	6.2	6.4	6.7	6.5	6.8
gross cropped area (Mha)	131.9	147.3	152.8	155.4	159.7	163.8	167.4
area sown more than once (Mha)	13.1	18.1	19.6	19.1	22.1	25.1	26.2
net sown area (Mha)	118.8	129.2	133.2	136.3	137.6	138.7	141.2

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Gross cropped area has shown steady rise from 153 Mha in 1960-61 to 167 Mha in 1970-71. The overall percentage area under foodgrains declined from around 76 per cent of gross cropped area in 1950-51 to about 74 per cent in 1970-71. Share of crops like jowar, gram and all pulses has also shown some decline in per cent area. Area under wheat has on the other hand increased from 7.6 per cent in 1950-51 to 8.5 and 10.8 per cent in 1960-61 and 1970-71 respectively. Area under cotton remained steady at between 4.7 and 4.8 per cent during 1968-69 to 1970-71 There has been a slight decrease in the area under groundnut. Appendix 14.6 Statement I gives Statewise cropping patterns during 1969-70 and 1970-71. Main crops of each State which among themselves cover about 70 per cent or more of the gross cropped area of the State are listed below:

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State	Principal crops*	Code form
Assam	Pd 71	Pd 1
West Bengal	Pd 71	Pd 1
Orissa	Pd54 Pu9 Fr5	Pd 2 Pu4 Fr5
Bihar	Pd49 W10 Pu11	Pd2 W4 Pu4
Madhya Pradesh	Pd21 W17 J11 Mt8 Pu9 G8	Pd4 W4 J4 Mt5 Pu5 G5
Uttar Pradesh	W24 Pd19 G10 M7 Pu5 S6	W4 Pd4 G4 M4 Pu4 S5
Himachal Pradesh	W36 M28 Pd 11	W3 M3 Pd4
Jammu & Kashmir	M30 Pd 29 W11	M3 Pd4 W4
Punjab	W39 F14 M10 C7 Pd7 G7	W3 F4 M4 Pd5/G5/C5
Haryana	W21 B19 G22 Pd5 J5	W4 G4 B4 Pd5 J5
Rajasthan	B30 W9 G9 F4 J8	B3 W4 G4 F4 J5
Gujarat	B20 J13 Gn 17 C17 Pd5	B4 Gn4 C4 J4 Pd5
Maharashtra	J28 B11 C14 Pu9 F6	J4 C4 B4 Pu4 F5

Note J denotes jowar

* The subscripts against crops represent percentage of area under the crop to the gross cropped area in the State.

Karnataka	J21 Pd11 R9 Pu9 Gn9 C10 B5	J4 Pd4 R4 Pu4 Gn4 C4
Andhra Pradesh	Pd26 J20 Gn11 Pu9 Mt6 O5 B5	Pd4 J4 Gn4 Pu4 Mt5/O5/B5
Tamil Nadu	Pd35 J11 Gn13 Mt7 Pu5 B7	Pd3 J4/Mt5 B5/Pu5 Gn4
Kerala	L45 Pd30	L3 Pd3

14.6.2 The cropping structure of the country has been analysed using taluk as unit of area. The method followed for identifying the cropping patterns is explained in Section 2. As a first step, the existing cropping patterns of the States were studied. As these have been considered in detail in the respective State Reports, we have listed them here for ready reference in Appendix 14.6 Statement III . The frequency of cropping patterns beginning with each crop (Pd, Jk, Jr, B etc) is given in Appendix 14.6 Statement IV . These provide certain basic details of cropping patterns. The cropping patterns for the whole country are shown in Appendix 14.8 (Map IV).

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Cropping Patterns of Regions

14.6.3 As explained in Section 5, the country is divided into sixty two (62) rainfall Regions arranged under eleven groups I to XI. The crop distribution in taluks included in each of the Regions has been analysed and the cropping patterns of the various Regions drawn up. The cropping patterns in each of the Regions is discussed in sequential order of Groups I to XI. For each Region, the distribution of rainfall and list of cropping patterns are indicated together with a brief account of the yield levels of the main crops. The discussion concludes with remarks on the suitability of crops grown in the Region and includes suggestions for improvement of production as also for growing alternate crops. Basic information on the following items have been included for each Region in Appendix 14.6 (Statement V):

i) taluks with names of districts and States in which they are located;

ii) cropping patterns of taluks included in each of the States in the Region;

iii) geographical and gross cropped areas;

iv) rainfall zone numbers of States included in each Region; and

v) district irrigated areas.

14.6.4 The cropping patterns of Regions* 1 to 62 are discussed in the order listed below:

Group	Region	Remarks
I	1	No month with rainfall of 10 cm or more
II	2,3,5,6	Rainfall of at least C Type (10-20 cm) in one month during June to September
III	4,7 to 17	
IV	18 to 22	Rainy month of 10 cm or more beginning October
V	23 to 26	Rainy month of 10 cm or more beginning September
VI	27 to 29	Rainy month of 10 cm or more beginning August
VII	30 to 36	Rainy season for 4 months from July or 5 months from June; October is 10 -20 cm
VIII	37, 41,42, 44,45,47-49 and 55	Rainy season from May for 5 or 6 months
IX	56 - 62	Rainy season from April or March

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* The minimum rainfall considered is 10 cm pm.

Group	Region	Remarks
X		Two rainy seasons:
	38 - 40	a) one is May and second from August, September or October for 3, 2 and one month(s) respectively
	43,50,51,52, 53,46	b) from January for two to three months and from June or July
XI	54	From January for 4 months

Group I: No month with rainfall of 10 cm or more

14.6.5 **Region 1 - E4 (E4) E4:** There is only one Region in this group. This is the region with lowest rainfall in the country. Rainfall of less than 10 cm per month is received during the monsoon. It covers an area of 135,309 sq km forming 5 per cent of the total ~~geographical~~ reporting area of the country. The Region accounts for 2.7 percent of the all-India gross cropped area spread over five States. The share of Rajasthan is 60 per cent and that of Punjab and Haryana together 36 per cent. Areas in Himachal Pradesh and Jammu & Kashmir are negligible. While in the areas in Punjab and Haryana, rainfall of 5-10 cm pm occurs for three months from July to September, in the areas in Rajasthan it occurs in only two months i.e. July and August. In Ladakh area of Jammu & Kashmir, rainfall is not more than 5 cm in any month. In the rest of that State, rainfall is 5-10 cm pm in July and August as well as during January to May.

14.6.6 The cropping patterns of the region are listed below:

i) Pd2 M4
(ii) Pd3 M3 O4/V4 Fr4
iii) B1
iv) B2 Pu3

v) B3 Pu3
vi) Mt3 W4 Pu4/Ba4
vii) Pu2 B3
viii) Pu3 B3 / F3
ix) C4 W4 F4/G4
x) G3 W4 B4 C4
xi) G4 W4 B4 C4
xii) W4 C4 F4/G4
xiii) W3 F4 G4 C4/O4
xiv) Ba2 Pu4/W4
xv) Ba3 Mt4 W4

Crop patterns which include gram cover the largest area (35 per cent) and the patterns with bajra, wheat and other pulses cover 16 to 18 per cent of the gross cropped area in the region. Cotton pattern occupies 10 per cent of the gross cropped area.

14.6.7 Bajra is the dominant crop of the region with 23 per cent area followed by gram, fodder, wheat, and other pulses each in the range of 12 to 15 per cent. Considered statewise, bajra is the dominant crop in Rajasthan covering nearly a third of total cropped area followed by other pulses (21 per cent), fodder (12 per cent), gram (12 per cent) and wheat (6 per cent). In Haryana, area under gram is 31 per cent, bajra 18 per cent, wheat 16 per cent and cotton 13 per cent of gross cropped area. In Punjab, wheat and cotton are about 25 per cent and gram and fodder 15 per cent each. Paddy covers 40 per cent in Jammu & Kashmir, maize and other oilseeds 20 and 10 per cent respectively, and wheat and small millets 6 per cent each. Irrigation facilities are good in the districts of Punjab and Haryana and Jammu & Kashmir and in Ganganagar district of Rajasthan. Yields of paddy are good and it is mostly grown under irrigation in Srinagar and Anantnag districts of Jammu & Kashmir. Cotton and wheat are also grown under irrigated conditions giving high yields.

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14.6.8 Rainfall by itself is totally insufficient for growing crops other than millets. While RYI of rainfed crop of bajra in the districts of Rajasthan is low varying from 23 to 45, it varies from 137 to 261 in various districts of Punjab and Haryana where the crop is irrigated. The RYI of wheat, gram, cotton and paddy are also well above the all India average going beyond even 300 per cent where the crops are grown with full irrigation support. Where wheat is grown only under rainfed conditions, the RYI is as low as 43. RYI of maize ranges from 65 and 70 in Jammu & Kashmir State where it is taken as a rainfed crop.

14.6.9 This region gets lowest rainfall in the country. Growing of arable crops will therefore have to be confined to low lying areas with good retentive soils. This can be done only after adopting appropriate soil conservation measures and water harvesting and other suitable agronomic practices. It is advisable to divert the areas from arable crops to forage and economic tree crops as sole crops or in mixture. More research and extension efforts will have to be put in with this objective in view.

Group II: Rainfall of 10 cm pm or more for one or two months during June to September

14.6.10 Regions - 2, 3, 5 and 6: This group includes four regions with 10 cm pm or more of rainfall during one or two of the four monsoon months, June to September, as indicated below:

Region	Rainfall pattern	Rainfall types in			
		June	July	August	September
2	E 4 (C1 E3) E4	E	C	E	E
	"	E	E	E	C
3	E4 (C2 E2) E4	E	C	C	E
	"	E	E	C	C
	"	C	E	E	C
5	E4 (B1 C1 E2) E	E	B	C	B
6	E4 (B2 E2) E4	E	B	B	E

14.6.11 Region 2 - E4 (D1 E3) E4: This region includes 85 taluks from Gujarat, Maharashtra, Andhra Pradesh and Karnataka with a cropped area of 5 per cent of the total cropped area in the country. Only during July in the north or September in the south, 10 cm rainfall is received. Rainfall during remaining three months is mostly 5-10 cm pm. In the southern States rainfall is also 5-10 cm during October.

14.6.12 The 23 cropping patterns of the region are listed below:

i) Jk3 Gn4 Mt4 Pd5
ii) Jk4 Gn4 Mt4 Pu4/Pd4 Jr4/C4 Pu4/C4 R4
iii) Jk4 Mt4 B4 Gn4/Pu4 04
iv) B1
v) B2 Jk4/Jr4/Pu4
vi) B3 Gn3
vii) B3 Jk4 Pu4/Gn4/Jr4 Gn4/F4 Pu4/F4 E4
viii) B4 Jk4 Gn4 W4 Pu4
ix) Mt4 Gn4 Jk4
x) Pu4 F4 Jk4/ B4
xi) Pu4 Gn4 Mt4 W4 Jk4 C4
xii) Gn2 B4/ Jk4
xiii) Gn3 B3 / Jk4
xiv) Gn3 Jk4 Pu4 / C4 / To4 S4
xv) Gn4 B4 (F4 Pu4)/CE Jk4)/(Jr4 C4)/(Jr4 Jk4)
xvi) Gn4 Jk4 C4 Mt4 Pu4
xvii) C3 Gn4 Jk4/ W4/Jr4 W4/ Jr4 Jk4
xviii) C3 Jr4 Pd4 / Mt4
xix) C4 Jk4 Gn4 Mt4/Pd4/Jr4/W4/ W4 B4
xx) C4 Jk4 Jr4 B4/Gn5/B4 Mt4
xxi) Jr1
xxii) Jr2 B4/ Pu4
xxiii) Jr3 B3 / B4 C4 / Gn4 / C4 Jk4/ C4 W4

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Rabi jowar patterns cover a third of the cropped area, groundnut and cotton patterns 18 per cent each, bajra patterns 15 per cent and kharif jowar patterns 12 per cent. Pulses and minor millets patterns also occur in the region.

14.6.13 The [illegible] values of main crops of the region are as follows:

Relative Yield Index (percentage of all India)

District	Pd	Jk	B	Pu	Gn	C	Jr	S	Mt	W
Kutch		19	127	31	106	177				
Jamnagar	25	121		77	151					
Amreli	61	193		96						
Bhavnagar		35	167		93					
Sholapur			48					63		
Poona			80				52	136		
Satara			85	72			113			
Ahmednagar			65	51			72			
Sangli		155	32				61			
Anantpur		82			82	34	74			
Kurnool		79	89				86		53	
Cuddapah		92			98				50	
Bijapur		299	75		57	33	91			
Raichur	268	111	88	49	93	59	151			37
Bellary	175	182	118	62	125	60	139	191		
Dharwar		203	113	60	81	58				25

14.6.14 Reasons for low yields of bajra and rabi jowar in the districts of Maharashtra, those of cotton in Andhra Pradesh and Karnataka need to be studied with a view to take urgent measures either to increase the yields of these crops or for substituting them with more suitable crops.

14.6.15 Region 3 - E4 (C2 E2) E4: This is one of the larger regions and includes 136 taluks in seven States from Himachal Pradesh and Punjab in the north to Andhra Pradesh in the south and accounts for 8.9 per cent of the gross cropped area of the country. The largest area of the region is in Rajasthan. Areas in Andhra Pradesh and Himachal Pradesh are relatively smaller. There are only two months of 10-20 cm pm of rainfall and these are July and August in Gujarat and the northern areas, August and September in Andhra Pradesh and June and September in Maharashtra. In the remaining two months rainfall ranges from 5-10 cm pm (except in Punjab and Haryana, where this much rainfall is received only in September. In Maharashtra, during October also there is 5-10 cm of rainfall and in Andhra Pradesh both October and November record 5-10 cm pm. Himachal Pradesh gets 5-10 cm pm of rainfall from January to March and 5-10 cm pm or higher from June to October.

14.6.16 Thirty cropping patterns have been identified in this Region as indicated below:

i) Pd3 Gn4 Jk4
ii) M2 Pu4
iii) M3 Pu4 Gn4/04
iv) M3 G4 Ba4 Pu4/Jk4/Pu4 05/W4 05
v) M3 Ba4 Jk4 B4/(04 Gn4)
vi) M4 Ba4 P4 W4 D4/Jk4
vii) Jk3 B4 W4
viii) Jk3 Gn4 S4/S4 To4
ix) Jk4 M4 $\frac{W4}{04}$ $\frac{G4}{B4}$

x) B1
xi) B2 Pu4/F4/D4/G4
xii) B3 Pu3/Pu4/Pu4 G4/Pu4 F4/Pu4 W4/F4 D4/F4 Jk4/
Jk4 04/G3
xiii) B3 Jk4 F4/Gn4/C4
xiv) B3 Gn4 C4
xv) B3 Pd4 Pu4 /R4
xvi) B4 Jk4 04 C4
F4 W5 05
xvii) B4 Ba4 G4 (W4 Pu5)
Jk4 04)
xviii) B3 Jr3 /W4
xix) B4 Jr4 Gn4 Jk4
xx) Pu3 B3
xxi) 04 Pu4 F4 W4
xxii) Gn3 Jk4 Pu4/S4/Mt4
xxiii) G4 W4 B4/B4 S4/B4 Jk4
xxiv) W3 G4 Pd4/Pd4 B4/Pd4 Jk4/Jk4 B4/Jk4 S4
xxv) W3 F4 Pd4/M4/G4/B4 B4 G4/B4/C4/C4 M4
xxvi) W3 M4 Pd4
xxvii) W3 Mt4 Pd4
xxviii) W3 Mt4 Ba4 Pt4
xxix) Jr2 B4
xxx) Jr3 B3/B4 S4/B4 W4

It is interesting to note that although there are 30 cropping patterns, bajra is grown over half and wheat over 27 per cent of the gross cropped area in the region. Though gram occurs in one pattern area covered by it is 9 per cent. Thus, the patterns including these three crops cover 85 per cent of the gross cropped area of the region. Bajra has the largest area in three of the States including Rajasthan and is thus the major crop of the region. Maize is confined to Udaipur and Bhilwara districts. Wheat, the second most important crop of the region is largely confined to northern States. Although there is no pattern beginning with fodder, it is a significant crop in the northern States. Paddy area is extremely limited and it is one of the significant crops in wheat patterns of Punjab (W3 Pd4 M4/F4 etc.) and in Andhra Pradesh.

14.6.17 With only two months of 10-20 cm pm rainfall and with high variability of monthly rainfall, the crops that can be

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grown are mostly millets. Even for millets the rainfall distribution is not entirely adequate which is perhaps the reason for the areas under jowar being limited. In Rajasthan, cropping patterns mostly include bajra and other pulses; maize over a small area in Udaipur, Bhilwara and Ajmer districts. In Udaipur the area under maize is 40 to 50 per cent of the gross cropped area.

14.6.18 In Punjab and Haryana, yields of gram are generally high at 131 per cent of the all India level. Wheat yield is of the order of 1.6 times of the all India yield and this crop is almost entirely irrigated. In Gujarat, bajra and cotton yields are very good, the State averages being about 150 per cent of the all India yields. Bajra yield in Rajasthan is generally low being less than 50 per cent of the all-India level though in a few districts the yields are higher and almost equal the latter. The RYI of maize yield is 89 per cent of all-India in Udaipur and 73 per cent in Bhilwara. Bajra yields in Maharashtra are generally low. In Sangli and Kolhapur, it is only a third of the all-India level and in Ahmedanagar and Satara 65 per cent. Jowar yields are also low, the RYI being around 50 to 70 per cent. In Satara and Kolhapur, however yields equal the all India level .

14.6.19 Excepting Gujarat, the yield levels of crops without irrigation are on the low side, some of them being less than 50 per cent of all India in the case of bajra. It is, therefore very necessary to remedy the situation either by substitution with more suitable crops or by improving the yield levels of existing crops by developing and adopting better varieties or agronomic practices including water management techniques.

14.6.20 Region 5 - E4 (B1 C1 E2) E4 - The region accounts for 1.9 per cent of the all-India gross cropped area; 85 per cent of it lies in Gujarat and balance 15 per cent in Rajasthan. Rainfall distribution is 20-30 cm in July, 10-20 cm in August and 5-10 cm in June and September. The region has fifteen cropping patterns of which five are of groundnut, four of maize and three of bajra. Fifty one per cent of the cropped area of the region is covered by groundnut patterns and 23 per cent by bajra. There is only one cotton pattern (C2 Jk4/B4) and has subscript 2 indicating 50 to 70 per cent area but this covers 14 per cent of the region. Maize is grown mainly in Udaipur and Sirohi districts but the area covered by maize patterns is only 8 per cent. Fodder is a significant crop with a total area of about 4 per cent. Oilseeds and pulses, other than gram and tur, are also spread over significant areas. Groundnut is a major crop in Gujarat and maize in Udaipur and Sirohi districts of Rajasthan.

14.6.21 The cropping patterns in this Region are listed below:

i) M1
ii) M2 Ba4 J4/W5 Mt5/W5 O5
iii) M3 Jk4 Fd4/W4 C4
iv) M3 W4 Pu4 O4
v) B3 Gn4/Gn4 F4/Gn4 B4/Gn4/Jk4/Gn4/O4
vi) B4 Pu4 O4 W4/F4/Mt4
vii) B4 Jk4 W4 O4 /Gn4/C4/O5 Pu5
viii) E3 O4 M4
ix) F4 O4 M4 B4
x) Gn1
xi) Gn2 Jk4/B4/C4/J4
xii) Gn3 Jk4 B4/C4
xiii) Gn3 B4 F4/G4/Jr4/Jk4
xiv) Gn4 Jr4 F4 C4/B4
xv) C2 Jk4/B4

14.6.22 Groundnut yields in Gujarat show large variation the RYI ranging from 44 per cent in Surendranagar district to 137 per cent in Junagadh. RYI of all crops grown in this Region in many districts vary from 70 to 80 per cent. RYI of maize in Udaipur is 89 per cent and in Sirohi 85 per cent. Bajra yields in Gujarat are mostly higher than the all India level. There is scope for improving the yield levels of maize and bajra in Rajasthan districts by adopting better water management and agronomic practices and by substituting groundnut in Surendranagar district of Gujarat with sunflower.

14.6.23 Region 6 - E4(B2 E2)E4 - This is a small region comprising 0.9 per cent of the country's gross cropped area. Seventy per cent of the total area of the region is in Rajasthan and the rest in Gujarat but for one taluk in Jammu & Kashmir. July and August are the rainiest months with 20-30 cm pm. June gets 5 cm and September about 10 cm.

14.6.24 The cropping patterns of the region are as follows:

i) E3 M4 Ba4/Ba4 O4/Mt4 B4 F4
ii) E3 B4 O4 M4/Jk4/Jk4 F4
iii) E4 M4 Jk4 (Ba4Gn4)
M4 B4
Gn4 (C5/Jk4)
iv) B3 F4 Jk4/Jk4 M5 Mt5
v) B4 Gn4 M4 G4/W4 Jk4/Ba4 (Jk4/Pu4)
vi) Jk3 B4 W4/M4 (Ba4/M4)
vii) M3 M3
viii) M4 B4 G4 Gn4 Ba4

Maize, bajra, jowar and wheat are the main crops. Patterns with bajra, maize and jowar (kharif) cover nearly equal areas and total to 95 per cent. Wheat patterns have a small area of 5 per cent. Rainfall distribution is suitable for crops like jowar, cotton and groundnut and almost favourable for maize. Rainfall is in excess of what is generally needed for bajra. Maize is grown mainly in Rajasthan with RYI of 70 to 80 per cent. About seventy per cent of the wheat area in

Rajasthan is irrigated but its RYI is about 90 per cent. RYI of jowar is low at about 70 per cent. In Gujarat yields are better, the RYI of bajra being of 145 per cent, of maize almost 100 per cent and of wheat 116 per cent. The RYI of jowar (kharif) is only 60 per cent. Cotton in Rajasthan has RYI of 111 per cent though 65 per cent of the area under the crop is irrigated while with only 16 per cent irrigation in Gujarat, yield is 144 per cent.

14.6.25 Although the crops grown in the Region are suited to the rainfall patterns, yield levels are low in Rajasthan districts. There is definitely good scope for improvement of productivity levels by ensuring adoption of improved varieties or hybrids and better agronomic practices.

Group III: Rainfall for three consecutive months from July
or four from June with 10 cm pm or more.

14.6.26 This Group has 12 regions with medium to heavy amounts of rainfall for three or four consecutive months from July or from June respectively. Rainfall amounts vary from Class C in Region 4 to Class B in Regions 7 to 12 and class A in Regions 13 to 17. It can be seen that the Regions in this group generally get good rainfall from distribution point of view. It is, however, necessary to adjust the crops to suit the soil and other factors to get maximum yields.

14.6.27 Region 4 - E4 (C4/C3) E4: This is the biggest rainfall region in the country with its cropped area being 17 per cent of the country's gross cropped area. It has a total of 287 taluks spanning areas in ten States from Karnataka and Andhra Pradesh in the south to Uttar Pradesh and Himachal Pradesh in the north. The largest number of taluks are in Maharashtra (103) followed by 60 in Andhra Pradesh and

34 in Uttar Pradesh. The per cent area covered in each State is as follows:

State	Area (as percent of the total cropped area of the region)
Andhra Pradesh	18
Karnataka	8
Maharashtra	38
Madhya Pradesh	4
Gujarat	4
Rajasthan	4
Haryana	6
Punjab	4
Himachal Pradesh	Neg
Uttar Pradesh	12

The region gets 10-20 cm pm of rainfall for three consecutive months from July or four consecutive months from June. The cropping patterns identified number 57 and are distributed mainly among millets, paddy and wheat. These are shown in paragraph 14.6.30. The areas covered by the main crops are:

Crop	W	Jk	Jr	B	C	Pu	Gn	Pd	O
per cent area	14	11	13	11	11	9	6	5	5

Cotton, rabi jowar, bajra, gram, groundnut and other pulses are the main crops of Karnataka. Besides these crops, kharif jowar, small millets and paddy are important in Andhra Pradesh, paddy being almost entirely irrigated. Jowar (kharif and rabi), cotton and bajra dominate in Maharashtra. In Madhya Pradesh, jowar (kharif), cotton and other pulses are important. Bajra is the major crop in Rajasthan and Haryana areas with wheat and other pulses being other important crops. Wheat is more important in Haryana than in Rajasthan. Wheat dominates in Punjab accounting from 30 to 50 per cent of the area, the other important crops being gram, maize and paddy. Wheat is the major crop in Uttar Pradesh also with gram and bajra as other significant crops. Wheat and maize are the main crops of Himachal Pradesh and fruits and paddy are other important crops. Thus, the region is dominated by millets, cotton, wheat and other pulses. The first two crops of the cropping patterns in the portions of the States included in the Region, are shown in Paragraph 14.6.31.

14.6.28 Jowar (kharif) yields in the Region are around the all India level except in Gujarat where the RYI is 43 per cent, mainly because the crop is grown for fodder. Rabi jowar yield in Maharashtra, which has the largest area under this crop, is lower, (RYI being 80 per cent) but in Karnataka and Andhra Pradesh with large area. yields are close to all India level or higher. Yield of maize in Maharashtra is low at 72 per cent. Bajra is a major crop of the region with yields varying between 60 to 150 per cent., the lowest being in Rajasthan, at about 60 per cent. Gujarat, Haryana and Uttar Pradesh have higher yields. Rabi yield in Karnataka which has the largest area is around the all India level. Wheat in the irrigated areas of the north has high yields but in Madhya Pradesh yield is low. The position about cotton is

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the same. In areas where the crop is rainfed, as in the southern States, the RYI is only 40 to 60 per cent, the exception being Gujarat where irrigation is hardly 15 per cent but the yield index is 144 per cent. Groundnut in the Region has all India level of yield. Gram yields are 40 to 60 per cent in the south but good in the north.

14.6.29 The rainfall distribution of 10-20 cm pm for three or four months is suitable for millet crops; bajra and small millets in the lower ranges and jowar, cotton and groundnut in higher ranges i.e. with about 20 cm pm. The crop structure of the region largely reflects this distribution except where it is modified with irrigation. Inspite of the fact that the crops grown appear to be suitable to the rainfall situation, the yields are low in case of almost all crops grown in the region in Maharashtra, Madhya Pradesh and Rajasthan which suggests the need for detailed analysis and suitable remedial measures with regard to research as well as development efforts. This situatio also holds good for Andhra Pradesh and Karnataka with regard to gram and other crops, the yield levels of which are low.

14.6.30 The cropping patterns in this region are listed below:

Paddy patterns

i) Pd3 Jk4 Gn4
Jk4 04

Jr4 M4

M4

F4 Y4

ii) Pd3 R4 04 W4

iii) Pd4 Pu4 Jk4 (M4/04/Gn4)
Jr4 (M4/Jk4)

iv) Pd4 Jk4 $\frac{\text{Gn4(Jr4/Pu4/Mt4)}}{\text{B4 (O4/Jr4)}}$

Jowar (kharif) patterns

i) Jk3 Gn4 C4/O4/S4/B4/Jr4 (Pd4/Mt4)/Pd4 (R4/Pu4)
ii) Jk3 C4 Pu4/ Pu4 (B4/Gn4)/O4/Mt4 Jr5
iii) Jk4 Pu4 (B4 C4)/ Gn4 T5 Jr5
iv) Jk4 Pu4 O4 W4/B4/Gn4 (B4/Jr4 /Jr4 T4/G5)
v) Jk4 Pd4 (Jr4 O4/V4)/Pu4 O4/Mt4/Gn4 Mt4/R4 O4/C4 Mt4
vi) Jk4 Gn4 B4 Pu4 / Mt4/Pd4
vii) Jk4 Gn4 C4 W4/(Pu4 B4 M4)
viii) Jk4 Jr4 O4 V4

Maize patterns

i) M3 Pd4 Jk4
ii) M4 Pd4 Pu4 /Jk4 (O4/R4)

Bajra patterns

i) B1
ii) B2 Pu4
iii) B3 G3/G3 W4/G4 (Pu4/W4/O4/Ba4)/Pu4 Ba4 V4/C4 Gn4
iv) B3 W4 Jk4/Jk4 C4/F4 (Gn5/O5)
v) B3 Pu4/Pu4 C4/Pu4 C4 O4 / Pu4 Gn4
vi) B3 Jr3/Jr3 Pd4/Jr4 Pd4/ Jr4 Pd5
vii) B4 W4 C4 F4
viii) B4 W4 G4 Jk4/O4/F4/M4 Ba4
ix) B4 W4 Pu4 G4/Ba4/Ba4 G4 / O4/F4/Pd4 R4

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Cotton patterns

i) C2 Jk4
ii) C3 Jk3 / Jk4 (Pu4/W4/Pd4)
iii) C3 Pu4 Jk4/B4/Jr4/Gn4/Fr4
iv) C3 Jr3/ Jr4 Mt4
v) C4 Pu4 (Jk4 (B4/Gn4)/Jr4(B4/Gn4/O4)/Gn4 B4
vi) C4 Jr4 Jk4 Gn4/ Gn4(Pu4/Mt4)/Mt4(Pd4/B4)
vii) C4 Mt4 $\frac{\text{Jk4 Gn4}}{\text{Jr4 Pd4}}$

Other pulses patterns

i) Pu3 Jk4 B5 C5
ii) Pu4 Jr4 Jk4 (Gn4 T4) / M4 Pd4
Pu4 Jr4 Gn $\frac{\text{(Gn4/Jk4)}}{\frac{\text{O4 (Mt4/B4)}}{\text{T4 B5}}}$

iii) Pu4 B4 $\frac{\text{(C4 Jk4)}}{\text{(Gn4 Jr4/W4)}}$

gram pattern

i) G4 B4 W4 04 / Jk4/Jk4(Ba4/04)

Ragi pattern

R3 Mt4 04 Pu4 Pd4

groundnut patterns

i) Gn3 B3 B4 Jk4
ii) Gn4 Mt4 Jk4 Pu4/Jr4

fruits pattern

i) Fr4 W4 M4

potato pattern

i) Pt3 W4 M4

wheat patterns

i) W3 Pd4 M4 / M4 F4/M5 G5 / S4 B5 G5
ii) W3 M4 Gn4/F4/F4 Gn4/Pt4
iii) W3 Gn4 F4
iv) W3 G4 (M4 Pd4) /Ba4 Jk4 F5
v) W3 G4 Ba4 Pu4/Ba4 (Jk4/F5 Pu5/F5)
vi) W3 B4 M4/Ba4(Pu4/M4 S5)
vii) W4 B4 G4 Pd5
viii) W4 B4 G4 04/05/PG4(M4/Pu5)/Ba4 Pu4 M4
ix) W4 M4 Pu4 B4 (Pd4/Ba4)
S4
S4 F4
Pd4 Gn5

jowar rabi patterns

i) Jr1
ii) Jr2 T4/04/Pu4/B4
iii) { Jr3 B4
{ Jr3 B4 W4/Pu4 / 04/C4 (Pu4/04)/C4/W4
iv) Jr3 Pu4 04/B4/04/B4/W4/Pd4/Pd4 Jk4/Gn4/
04 R4 / G4 Jk4
v) Jr3 Gn4 Pd4/Mt4/Pd4 Mt4/B4(T4/B4/04)
vi) Jr4 04 T4/T4 B4/C4(Pu4/Gn4)
vii) Jr4 Gn4 Pu4 Mt4 /T4(Jk4/04)
viii) Jr4 Pu4 Pd4/Pu4 G4/Jk4(Pd4/04)

14.6.31 The first two crops in the cropping patterns of portions of the States in the region are as follows:

Karnataka	Andhra Pradesh	Maharashtra	Gujarat	Madhya Pradesh	Rajasthan	Haryana	Punjab	Himachal Pradesh	Uttar Pradesh
Pu4 Jr4	Pd4 M4/B4	Pd3 Jk4	Jk3 B4	Jk3 C4	B3 G3	B3 G3	W3 Gn4	Fr4 W4	W3 G4
C3 Jr3	Pd3 Jr4	Pd3 R4	B3 W4	Jk4 C4	B4 G4	B3 G4	W3 M4	Pd3 W4	W3 F4
C4 Jr4	Pd3 O4	Jk3 Gn4	B4 C4	Pu3 Jk4	B4 Pu4	G4 W4	W3 Pd4	W3 M4	W3 B4
Jr3 B4	Pd4 Gn4	Jk4 Pu4	Gn3 B3	C3 Jk4	G3B4	W3 B4			W4 B4
Jr3 B4	Pd4 Pu4	B1	C3 Jk4		G4B4				W4 M4
Jr4 O4	M3 Pd4	B2 Pu4	C4 Jr4						
Jr4 Gn4	M4 Pd4	B3 Jr3	W4 B4						
	Jk3 C4	B4 Pu4							
	Jk3 Gn4	Pu4 Jk4							
	Jk4 B4	Pu4 B4							
	Jk4 Gr4	C2 Jk4							
	Jk4 Pd4	C3 Jk3							
	Gn4 Mt4	C3 Pu4							
	C3 Jr4	C4 Pu4							
	C4 Mt4	Jr1							
	Jr3 Gn4	Jr2 Pu4							
	Jr3 Pu4	Jr3 B4							
	Jr3 Gn4	Jr3 Pu4							
	Jr4 Jk4	Jr4 O4							
	Jr4 Pu4	Jr4 Gn4							
		R3 Mt4							

14.6.32 The RYI values (percentage of all India) of the main crops for the different States in the Region are as follows:

States	Pd	Jk	Jr	M	B	R	Mt	W	G	Total pulses	Gn	C
Karnataka			116		88				61	68	92	53
Andhra Pradesh	118	89	94		104		56		39	34	103	45
Maharashtra	99	107	80	72	77	97	104		44	60	91	56
Gujarat		43	173		147						96	144
Madhya Pradesh		115							98	85		65
Rajasthan					61			92		71		
Haryana					128			162	131			
Punjab	142			138				181	124	156		
Himachal Pradesh	103			161				70				
Uttar Pradesh				89	149			100	147	162		

Region 7 - E4(B2 C1 E1) E4:

14.6.33 This is one of the big regions which accounts for 8.7 per cent of total cropped area of the country. It covers 171 taluks in seven States from Madhya Pradesh to Jammu & Kashmir. Uttar Pradesh has 86 taluks and Rajasthan and Madhya Pradesh 37 and 31 respectively. Punjab and Haryana together have 18 taluks. Rainfall is from July to September. Thirtyeight cropping patterns have been identified which are listed in paragraph 14.6.35. The areas covered by the cropping patterns are as follows:

Crop	No. of patterns	No. of taluks	Per cent of total cropped area
wheat (W)	13	77	50.8
gram (G)	5	27	16.4
paddy (Pd)	5	18	12.5
jowar (Jk)	5	18	9.4
maize (M)	4	16	4.4
bajra (B)	3	11	3.7
sugarcane (S)	1	2	2.0
barley (Ba)	1	1	0.4
fodder (F)	1	1	0.4
total	38	171	100.0

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The three major crops of the region are wheat, gram and paddy whose patterns together occupy 80 per cent of the cropped area. The other important crops are jowar, bajra and maize. Fodder is of some significance. Wheat yields are highest in Punjab and Haryana where 80 to 85 per cent of the crop is irrigated. Two-thirds of wheat crop in Uttar

Pradesh and Rajasthan are irrigated but the yield is the same as all India average; Yield of wheat in Madhya Pradesh is low, less than 60 per cent of the national average; only 15 per cent of the crop is irrigated in the State. In Udaipur, Dungarpur, Banswara and Chittorgarh districts of Rajasthan, yield of maize was only 88,61,61, and 100 per cent respectively of all-India; on the whole yields are below all India level. Yield of jowar in Madhya Pradesh is above all India and in Rajasthan area close to all India level. Bajra is largely concentrated in Bharatpur and Sawai Madhopur districts whose yields are 135 to 145 per cent. In Uttar Pradesh, area under bajra is small but yields are about 150 per cent. Gram is important in Uttar Pradesh with yield above all India level. Paddy yields are low, only 70 per cent.

14.6.24 In spite of fairly good irrigation support the reason as to why wheat yields in Rajasthan and Uttar Pradesh should not be at almost the same level as in Punjab needs to be looked into. Similarly, examination is necessary with regard to maize in Rajasthan and paddy in Uttar Pradesh. The question as to what extent the yields of wheat grown under rainfed condition could be raised by providing irrigation support requires study. If it is not possible to provide irrigation support to wheat and raise its yields under rainfed conditions, it is worth considering as to why this area should not be diverted to safflower or such similar crops. Paddy yields cannot be high without irrigation support and, therefore, it may be advisable to divert paddy area to maize or other suitable crops after providing for proper drainage facilities.

14.6.35 Cropping patterns in this region are as follows:

i) Pd3 W3

ii) Pd 3 W4 Ba4 Pu4 / M4 /Pu5

iii) Pd4 W4 B4 Ba5 / Ba4 G4/ Ba4 T4

iv) Pd4 W4 G4 S4 / Pu5 /Jk4 / Ba4 Pu4 / Ba4 /Ba4 Jk4

v) Pd4 W4 Ba4 Jk4 / Pu4 Jk4/Pu4 M4

vi) M3 Mt4 Pd4 / W4

vii) M3 W4 Ba4 / Ba4 04/ G4 Pd4

viii) M4 Pd4 Mt4 G4 / W4

ix) M4 Jk4 Gn4 W4

x) Jk3 W4 F4 / F4/ Pu4 / 04 G4 / C4 / C4 F4

xi) Jk3 Gn4 C4 / F4 C5 M5

xii) Jk3 B4 04 Pu4

xiii) Jk3 Pu4 F4 W4 / M4 /Gn4

xiv) Jk4 W4 F4 Gn4 Pu4

xv) Jk4 W4 M4 Gn4 / Pu4

xvi) B3 G4 04

xvii) B3 W4 B4 / Gn4 / Gn4 B4

xviii) G4 [illegible] Gn4 / 04

xix) F4 M4 [illegible] Jk4 Gn4

xx) G3 M3 / W4 Jk4

xxi) G4 W4 04 Pu4 / B4 /T4 /Jk4

xxii) G4 Jk4 Ba4 W4 Pd4 /B4

xxiii) G4 Jk4 W4 B4 / 04

xxiv) G4 Pd4 Ba4 B4 / [illegible] W4 / [illegible] T4

xxv) Ba4 Pd4 W4 B4 Pu4

xxvi) W3 G4 Jk4 / Pd4 / Jk4 Pd4 / Jk4 O4

xxvii) W3 M4 Pd4 / F4 / F4 G4 / Ba4 / Pd4 Fr4

xxviii) W3 S4 F4 / Pd4 / M4 F4 / M4 Ba4 / Pd4 F4 / Pd4 B4

xxix) W4 Jk4 O4 / F4 /G4 / F4 Mt4 Pu4

xxx) W4 S4 F4

xxxi) W4 Pd4 S4 F4 /G4 /G4 K5

xxxii) W4 G4 B4 O4

xxxiii) W4 M4 F4 G4 Gn4

xxxiv) W4 Pd4 M4 G4 / Ba4 Jk5 / Ba5 S5

xxxv) W4 Pd4 G4 S4 / Pu4 Jk4 / Gn4 Ba4 / Ba4 Jk4 / B4 Jk4 / Jk5 S5

xxxvi) W4 Pd4 M4 G4 B4 / Ba4/5 Gn4 / S5 / Jk4 / Jk5 S5 / B4 O4 / Gn4 Ba4

xxxvii) W4 M4 Pu4 Jk4 G4

xxxviii) W4 M4 B4 Gn4/5

14.6.36 Region 8 - E4 (B2-C2) E4: The region has 3.3 percent of total cropped area and includes 55 taluks spread over six States from Bihar to Gujarat, Maharashtra and Andhra Pradesh, Madhya Pradesh has the largest area. July and August are the rainiest months in the region with 20-30 cm pm and 10-20 cm pm in June and September.

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14.6.37 The twentythree cropping patterns of the region are as follows. Of these four are with paddy, five with jowar (kharif) and three each with cotton and wheat.

i) Pd2 Pu4 / M4

ii) Pd3 Pu4 / M4 (Jk4/Pu4)

iii) Pd3 Ba4 Pu4 W4 / T4

iv) Pd4 W4 Pu4 /M4 / M4 Pu4 / G4 (Ba4/S4)

v) M3 Pd4 Gn4 / G4 / G4 Gn4 / Jk4 Mt4 / Jk4 C4 G4

vi) M4 Jk4 C4 F4 Mt4

vii) Jk3 C3

viii) Jk3 C4 Pu4 /F4 (W4/G4)

ix) Jk4 M4 Pu4 Gn4 C4/B4

x) Jk4 C4 Jr4 Pu4/5

xi) Jk4 W4 F4 G4/C4

xii) Mt4 Pu4 Jk4 B4/M4

xiii) Pu3 Pd4 W4/ M4/G4

xiv) Pu4 Jk4 Jr4 C4 Gn5 O5

xv) C3 Jk3

xvi) C3 Jr4 To4

xvii) C4 Pu4 Gn4 F4 Mt4 / W4 G4

xviii) Jr4 Pu4 Pd4 / Jk4 /Gn4

xix) B4 M4 Pd4 R4

xx) W3 Jk4 G4 / G4 S4

xxi) W4 Pd4 G4 S4 / Gn4 Ba4

xxii) W4 G4 Jk4 F4 / Pu4 F4

xxiii) F4 Jk4 W4 G4

The main crops are paddy, wheat, jowar, cotton and maize. Gram and barley have significant areas in some of the taluks. One pattern starts with fodder and another has tobacco as a constituent crop. The near absence of bajra may be noted; the bajra pattern covers only a single taluk. While paddy with wheat and/or maize dominates Bihar and even Uttar Pradesh patterns, it gives place largely to millet and cotton in the rest of the region excepting for some paddy in Andhra Pradesh which is entirely irrigated. Rabi jowar is prominent in Andhra Pradesh. Rainfall distribution is not suitable for growing paddy but yet it has large areas in Bihar and Uttar Pradesh and to some extent even in Madhya Pradesh. Paddy in Andhra Pradesh is almost entirely irrigated. The paddy yield levels are low except where the crop is irrigated and the same is true of wheat also.

14.6.38 The region is endowed with good rainfall. There is no reason why the yield level should not improve. Growing of paddy and wheat where the yield levels are low without irrigation does not appear to be advisable. Either irrigation facilities should be developed wherever possible or areas should be diverted to other appropriate crops after study.

14.6.39 Region 9 - E4 (B4/B3 E4) E4 : The cropped area is 2.5 per cent of total and includes areas in Bihar, Uttar Pradesh and Andhra Pradesh. Rainfall is 20-30 cm pm for three months from July or for four from June. There is uniformity in distribution of rainfall. Andhra Pradesh area is only 5 per cent but Uttar Pradesh covers half of the region.

14.6.40 Nine cropping patterns can be identified in the region, which are paddy oriented; and these cover 85 per cent of the area. The following are the cropping patterns of the Region:

i) Pd2 Pu4 /W4 /M4

ii) Pd3 W4 / W4 / G4 / Ba4 / Pu4 / Pu4 Ba4 / Pu4 Ba4 S4 / M4 S4/M4 Pu4

iii) Pd3 Pu4 Ba4 / Ba4 M4

iv) Pd3 Jr4 S4 / Pu4

v) Pd4 W4 Ba4 Mt4 / M4 Pu4 / (Pu4 G4/5)

vi) M3 W4 Pd4 / Pu4

vii) Ba4 W4 M4 Pd4

viii) G4 W4 Pu4 Pd4 M4 / Ba4

ix) Jr4 Jk4 Pu4 G4

The rainfall distribution is insufficient for paddy. But there is large area under the crop in the Region which reflects the desire of farmers to go in for this crop. They expect above normal conditions to prevail every year which may happen once in three years at the most. Consequently the yield level is low i.e. 70 to 80 per cent or less of all India. In Andhra Pradesh, rice crop is almost entirely irrigated.

14.6.41 This is another region much better endowed with rainfall both in terms of quantity and its distribution. Yield levels could be high but it is not so because a crop like paddy dominates for which rainfall is not sufficient and irrigation facilities required are not available. Yield levels of other crops are also low. Hence, careful examination is suggested.

14.6.42 Region 10 - E4 (A1 C3) E4: The entire region is in Gujarat and its cropped area is 0.4 per cent of all-India. It covers portions of Junagadh, Surat and Broach districts. July is the rainiest month with more than 30 cm pm and the rest are in 10-20 cm class. Six cropping patterns are discernible two with groundnut, three with cotton and one with jowar. Groundnut (47%) and cotton (48%) patterns cover together 95 per cent area. The major crops are groundnut in Junagadh area and cotton elsewhere. Yield of groundnut in Junagadh district is good at 137 per cent of all India yield; that of cotton in Surat and Broach is 115 and 154 per cent respectively of all India. The cropping patterns in this region are listed below:

i) Gn1
ii) Gn2 W4 / C4 /B4 / F4 Jk4
iii) C1
iv) C2 Jk4
v) C2 Jr4 / F4
vi) Jk3 C4 Gn4 Pd4/Jr4

14.6.43 Looking to the amount and distribution of rainfall there can be a temptation for paddy cultivation. It is really gratifying that crops other than paddy are being cultivated in this region and with good yields. This can, therefore, be quoted as a very good example where the cropping patterns have been stabilized after taking the minimum rainfall, i.e. on lower side of the normal, into account. In the areas of above average rainfall drainage aspect is taken care of fully. In some other regions with almost similar rainfall patterns, paddy is grown resulting in unsatisfactory yield levels. The example of farmers of this Region is worth emulating by farmers in other Regions.

14.6.44 Region 11 - E4 (A1 B1 C1 E1) E4: The cropped area of the region is 1.4 per cent of the country's gross cropped area. The 36 taluks of the Region belong to five States of which 14 taluks are from Gujarat and six from Madhya Pradesh. The rainy season is from July to September. Rainfall decreases from more than 30 cm in July to 20-30 cm in August and to 10 to 20 cm in September. June rainfall is 8 to 10 cm. There is no other month with even 5 cm rainfall.

14.6.45 The Region has eleven cropping patterns as indicated below:

i) Pd4 B4 Pu4 Ba4 W4 G5
ii) M2 Pd4
iii) M3 W3 / W4 G4
iv) M4 C4 Pd4 Gn4 O4 / Mt4
v) Jk3 C3/ C4; G4 /M4 /G4
vi) Jk3 C4 F4 M4 /Gn4 /W4
vii) B3 Pd4 W4 / To4 W4
viii) B4 Pd4 Jk4 W4 /F4 /C4
ix) Gn3 B4 C4
x) Gn4 B4 C4 /M4 C4 / M4 Pd4
xi) C4 Gn4 M4 B4 / B5 Jk5
xii) W3 M3
xiii) W3 Jk4 O4 /B4 /G4 /Mt4 /M4

Wheat, maize, jowar and groundnut are the important crops. The main crops in each of the State areas in the Region are:

Himachal Pradesh	maize and wheat
Rajasthan	jowar, wheat and gram
Uttar Pradesh	wheat, maize, jowar, small millets, barley and paddy
Madhya Pradesh	jowar, cotton and fodder
Gujarat	groundnut, maize, bajra and cotton

Cropping patterns centred around jowar, wheat, groundnut and paddy with about 30 per cent, 20 per cent, 16 per cent and 14 per cent respectively of the gross cropped area of the Region. Share of bajra and of maize are each about 8 to 9 per cent in total area.

14.6.46 Maize yield in Himachal Pradesh is above all-India level but wheat is only 65 to 70 per cent. In Kotah district jowar yield is the same as all-India but yield of wheat and of gram are only 67 per cent and 84 percent respectively. Cotton yield in Madhya Pradesh is about 60 per cent and jowar yield is above all-India level. Wheat and barley yields in Uttar Pradesh area are only 80 per cent of the national level but that of maize is at par with all-India yield wherever yields of small millets and jowar are even higher. In Pratapgarh district, where paddy dominates, the crop yield is only 55 to 60 per cent of all-India yield.

14.6.47 In spite of the fact that rainfall is good for majority of crops grown in the Region, except paddy, yield levels of many of the crops are low except in Gujarat. Yields of jowar are fairly good but could have been better. Paddy yields cannot be expected to increase unless irrigation is provided. It is, therefore, necessary to go into the cropping structure in detail with a view to bringing about improvement in structure and productivity.

14.6.48 Region 12 - E4 (A1 B1 C2) E4: The Region includes 4 per cent of the gross cropped area of the country and extends over six States. Distribution of area among the States is as follows: Bihar (8 percent), Uttar Pradesh (9 per cent), Madhya Pradesh (29 per cent) Gujarat (16 per cent), Maharashtra (30 per cent) and Andhra Pradesh (8 per cent). Rainfall distribution begins with 10-20 cm in June, rises

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to more than 30 cm in July and decreases to 20-30 cm in August and 10-20 cm in September.

14.6.49 Twentynine cropping patterns have been identified and are listed below :

i) Pd1
ii) Pd2 Pu4
iii) Pd3 Mt4 Pu4 / O4 / G4
iv) Pd2 Jr4
v) Pd4 M4 Pu4 Jr4 / W4
vi) M3 Pd4 Mt4
vii) M4 Pd4 Mt4 [B4(C4/Gn4)] / Gn5
viii) Jk3 C4 O4 / Pu4 / Gn4 /Pd4 / W4 /T4 /F4
ix) Jk3 Gn4 T4
x) Jk4 C4 O4 Pu4 / Jr4
xi) Jk4 Mt4 W4 (O4 Pu4/G4)/(Pu4 G4/T4)
xii) B3 To4 Mt4 / Mt4 Pd4
xiii) Mt3 W4 G4 Jk4
xiv) Mt4 Pu4 Pd4 Gn4 C4
xv) Jr4 O4 W4 Pd4 Jk4 / Pu4 /C4
xvi) Jr 4 C4 Pd4
xvii) Gn4 Pd4 [illegible] C4
xviii) C1
xix) C2 Jk4
xx) C3 Jk3 / Jk4 / Jk4 W4
xxi) C4 Pd4 (Mt4 Jk4) / (Mt4 Gn4) / (B4 M4) / (B4 To4 Jk4)
xxii) C2 Jr4 / Pd4
xxiii) C3 Jr4 Jk4 / Pd4 /B4
xxiv) C3 Jr4 Pd4 To4 / B4 M4
xxv) W3 Jk4 F4

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xxvi) W3 C4 O4 / Jk4

xxvii) W4 Pd4 Gn4 S5

xxviii) W4 Pd4 G4 M4 / S4 / S4 B5 / M4 S4

xxix) To3 B4 Pd4

The number of patterns under different crops with respective per cent areas covered by them are as follows:

Crop	Pd	M	Jk	B	Mt	Jr	Gn	C	W	To
no. of patterns	5	2	4	1	2	2	1	7	4	1
per cent area covered by patterns	16	3	28	2	3	6	0.5	27	14	1

For convenience the main crops in different States of the region are shown below in symbols.

Bihar	Uttar Pradesh	Madhya Pradesh	Gujarat	Maharashtra	Andhra Pradesh
Pd	W	Jk	C	C	Pd
Pu	Pd	W	Jr	Jk	Jk
M	G	Pd	Jk	Jr	Jr
W	S	F	B	Pu	Pu
		O	Pd	W	
		G	M		
		C	Gn		

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14.6.50 Paddy in Andhra Pradesh is almost entirely irrigated and the yield is above all India level. Elsewhere, it is mostly rainfed with low yields of 70 per cent or less. Rainfall is insufficient for paddy. Cotton yields in Madhya Pradesh and Andhra Pradesh are low - less than 60 per cent, but in Gujarat where the crop is mostly rainfed the yields are well above the all India level.

14.6.51 The rainfall distribution of the region seems more suited to millets, maize and cotton but not for paddy. Paddy growing without facilities for providing supplemental irrigation does not seem to be justifiable. Similarly, low yield standards of crops in some of the States on one hand and good levels in Gujarat, on the other, under similar rainfall conditions is difficult to explain. It is, therefore, recommended that cultural practices adopted in the State where the yields are good should be studied and extended to other areas in the region, in addition to carrying out the needed research.

14.6.52 Region 13 - E4 (A2 C1 E1) E4 and Region 14 - E4 (A2 C2) E4: Rainfall distribution during July to September is the same in both the regions and hence these are discussed together. Both have areas in Madhya Pradesh, Uttar Pradesh and Himachal Pradesh and Region 13 covers in addition areas in Jammu & Kashmir, Rajasthan and one taluk of Punjab. The cropped area in Regions 13 and 14 are 3.5 per cent and 2.4 per cent respectively of total. Ninetyone per cent of the cropped area of Region 14 is in Madhya Pradesh, 2 per cent in Himachal Pradesh and the rest in Uttar Pradesh. The Regions lie close to each other in the plains but are a little away, though close, in Himachal Pradesh and Jammu & Kashmir.

14.6.53 The rainiest months are July and August with more than 30 cm pm but rainfall in September is only 10-20 cm pm. In Region 14 June also gets 10-20 cm. The sudden drop in rainfall in September and rapid rise from June to July may be noted. October rainfall is small and negligible. The high variability of September and October rainfall is another notable feature.

14.6.54 The cropping patterns of the Regions are shown below side by side, for comparison:

	Region 13		Region 14
i)	Pd3W4 M4/Mt4/(Ba4 G4)/ (Pu4 C5/G4/5)	i)	Pd1
ii)	Pd4 Ba4 W4(G4 Jk4)/ (G4 Mt4 B4)/(B4/S4)	ii)	Pd2 Mt4/Pu4
iii)	M3 W4 Pd4/(G4 Pd4)/ C4 Mt4/(Ba5 O5)	iii)	Pd3 Mt4 O4/W4/Pu4/G4
iv)	M4 Pd4 Mt4 C4 G4	iv)	Pd3 W4 O4/Mt4/S4/G4 Mt4 Pu4
v)	Jk3 M4 C4/W4 C4	v)	M3 W3
vi)	Jk3 W4 G4/M4/G4 B4	vi)	Jk3 W4 F4/G4
vii)	G3 W4 Jk4/Pd4/Jk4(T4/ O4/Ba4)/O4 Ba4	vii)	Mt3 Pd4 O4/Ba4/M4
viii)	W3 M3 Pd4 O4	viii)	G3 W4 Pu4/Jk4
ix)	W3 M4 B4/Pu4/(Pu4B4)/ Pd4/Pu4 Pd4	ix)	W3 C4/F4/Jk4
x)	W3 G4 Jk4 O4/Pd4(O4/G4)/ Pd4	x)	W3 G4 Pu4/F4/O4 Pu4
xi)	W4 Mt4 Pd4 (O4/G4)	xi)	W3 Jk4 G4/F4/B4/G4
xii)	W4 Mt4 F4 (Jk4 Pd4)/ Ba4/(B4/Pd4)	xii)	W3 M3/M4(Pd4/Ba4)
		xiii)	W3 Pd4 G4/O4
		iv)	W4 Pd4 Mt4/O4

Wheat and paddy patterns have the largest areas but in Region 13, jowar (kharif) and gram patterns also cover substantial areas.

Patterns	Region 13 (% area)	Region 14 (% area)
paddy	29.8	36.6
wheat	37.2	51.5
gram	14.5	1.9
jowar(kharif)	14.1	6.4
small millets	-	2.9
maize	4.5	0.6

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14.6.55 Important crops of region 13 are wheat, paddy, jowar and maize Gram and small millets have also significant areas. Wheat is the main crop in Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh and Punjab areas. In Uttar Pradesh area there is no pattern beginning with wheat but paddy and wheat go together in the paddy patterns. In Madhya Pradesh, wheat is predominant. In Rajasthan, jowar and wheat occupy considerable area but in Banswara district, maize dominates. Small millets, paddy and gram are also important. Gram is major in Banda district of Uttar Pradesh with G3 W4 Jk4/Pd4 pattern. In Region 14, wheat and paddy are the major crops. The other important crops are gram, pulses other than tur and gram, maize, oil seeds other than groundnut and small millets. Paddy dominates the eastern areas and wheat in the rest of the region.

14.6.56 Wheat yields in Uttar Pradesh and Rajasthan are close to all-India but in Madhya Pradesh it is only 57 per cent and in Himachal Pradesh 70 per cent. This is due to the fact that two-third of wheat area is irrigated in Rajasthan and Uttar Pradesh whereas the irrigated area is only 15 per cent in the other two States. Rice yields in the principal areas are low and of the order of 70 per cent only. This is due to low and uncertain rainfall of September and lack of supplemental irrigation. Jowar yields are good (115%) in Uttar Pradesh and Madhya Pradesh but over 70 per cent in Rajasthan where the area is not large. Maize yields are 90 per cent or less except in Himachal Pradesh where the yield is as high as 161 per cent. Gram yield is about 95 per cent of all-India in Uttar Pradesh and Rajasthan but 78 per cent in Madhya Pradesh. The yield of small millets is low in Madhya Pradesh (62%) and Rajasthan (83%) but high in Uttar Pradesh (163%) and Himachal Pradesh (226%).

14.6.57 In brief, it can be stated that the yield levels of paddy and wheat, the two major crops of the Regions, are on the low side. The reason for this state of affairs cannot be any other than insufficient moisture supply. Rainfall, especially in September, is not sufficient to support rice crop and irrigation facilities are wanting for paddy as also for wheat. Yields of a few other crops are also low in some of the States in the Region. The only way to remedy the situation is to study the various aspects and evolve and adopt appropriate measures.

14.6.58 Regions 15 and 16 - E4 (A2 B1 C1)E4 and E4 (A2 B2) E4:Region 15 and 16 have been grouped together as they have the same rainfall distribution during July to September. Their cropped areas are 7.6 and 7.2 per cent respectively of the total and cover adjoining areas to a large extent. The distribution of areas in the different States is as follows:

States	Percentage area covered	
	Region 15	Region 16
Andhra Pradesh	1	1
Maharashtra	3	9
Madhya Pradesh	20	34
Gujarat	4	-
Himachal Pradesh	neg.	-
Uttar Pradesh	30	-
Bihar	35	30
West Bengal	6	-
Orissa	-	25

July and August are the rainiest months with more than 30 cm pm but September gets only 20-30 cm. June is C class in

Region 15 and B in Region 16.

14.6.59. The Cropping Patterns of Regions 15 and 16 are as follows:

Region - 15

i) Pd1
ii) Pd2 W4/Pu4/M4/Mt4/R4
iii) Pd3 W4/W4 G4
iv) Pd3 W4 S4/Pu4/Ba4/M4 Pu4/M4/Pu4 Mt4
v) Pd3 Mt4 O4/Pu4
vi) Pd3 M4 O4 Pu4/Mt4
vii) Pd4 W4 S4/M4/S4 G4/S4
viii) Pd4 Mt4 O4 W4 Ba4
ix) Pd4 C4 Jk4 Gn4/Gn4 Mt4
x) Jk4 C4 Pd4 Gn4
xi) Mt3 O4 (W4 G4)/W4 Pd4/Ba4 Pd4
xii) Mt3 Pu4 Jr4 C4
xiii) C2 Jr4
xiv) C3 Jr4 Pd4/Pd4 Gn4
xv) C4 Pd4 Pu4 Jk4/S4
xvi) C4 Pd4 Gn4 (Mt4 M4)/Jk4 Fr4
xvii) G4 W4 Pu4 Jk4
xviii) Jr2 Gn4 W4
xix) Jr3 Pd4 Gn4 Pu4/Jk4
xx) Jr3 Pu4 Pd4/O4
xxi) Jr4 Pd4 Mt4 O4
xxii) W3 Pd4 M4
xxiii) W3 O4 Pu4/G4 Pu4

Region - 16

i) Pd1
ii) Pd2 Pu4/Mt4/O4/W4/M4/Jr4/Pu4 O5
iii) Pd3 Jr4/Pu4/Pu4 M4/ Pu4 W4
iv) Pd3 Mt3/Mt4 O4 /Mt4 O4 M4
v) Pd3 Pu4 W4/M4/M4 W4/Mt5 O5
vi) Pd3 Jk4 Pu4/Fr4/C5/R4
vii) Pd4 R4 O4 Pu4/Mt4 Jk5
viii) C4 Jk4 Pd4
ix) R4 O4 Pd4 Mt4
x) Mt3 Pd3
xi) Jr3 Pd4
xii) Jr4 W4 O4 Jk4

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Region 15

xiv) W4 Pu4 O4

xxi) W4 Mt4 Pd4 G4/O4

14.6.60 Seventythree per cent of cropped area is covered by the nine paddy patterns in Region 15. In Region 16, 97 per cent of cropped area is under paddy patterns. The rainfall criterion for paddy of not less than three months with 30 cm pm or more is not satisfied, though it is nearly so. By proper water management, moisture stress during September could be met.

14.6.61 The position regarding yields is that in most of the States they are low and 70 to 80 per cent only. Paddy is the main crop of these regions but yields are low. One of the main reasons is insufficiency of rainfall especially in September and possibly in June. Providing for supplementa irrigation will go a long way in increasing and stabilising paddy yields. Where it cannot be done, it is better to divert paddy areas to other crops. These Regions are more suitable for paddy than other crops and hence necessary steps should be taken for providing irrigation facilities.

14.6.62 Region 17 - E4 (A3 B1) E4. The total cropped area of the Region is 0.2 per cent of all-India and includes taluks in Vasad, Dangs (Gujarat) and Thana and Nasik (Maharashtra). Rainfall is greater than 30 cm pm for three to four consecutive months and is well suited for growing rice. This is reflected in the cropping patterns which are as follows:

i) Pd1

ii) Pd2 Pu4/Mt4/Fr4

iii) Pd3 R4 Pu4/Mt4

iv) R3 O4 Pu4 M4/Mt4

At higher elevations and in tribal areas of Dangs, Dharampur etc., ragi and small millets assume greater importance. Paddy yield is 138 per cent in Thana and just at the all-India level in Bulsar. Ragi yields are about 90 per cent.

14.6.63 Water resources through rainfall are more than adequate for growing paddy in valleys and hill-millets in elevated areas. Paddy yields are fairly good and could be raised further especially in Bulsar district of Gujarat. There is good scope for increasing the yields of ragi by adopting better varieties and agronomic practices. Being heavy rainfall areas, there is scope for introducing improved varieties of grasses, forage and legumes. It is worth trying soybean in rotation with ragi. Maize could also be tried. The Region is good for production forestry and economic tree crops.

Group IV: Rainy season from October
for one to three months.

14.6.64 Regions 18-22: In this group five Regions (18 to 22) are included where effective rainfall of more than 10 cm pm occurs only in October or continues for one or two months thereafter i.e. only during post-monsoon months. The rainfall patterns for these Regions are given below:

Region 18 - E4 (E4) C1 E3
Region 19 - E4 (E4) C2 E2
Region 20 - E4 (E4) B1 C2 E1
Region 21 - E4 (E4) B2 C1 E1
Region 22 - E4 (E4) A1 B2 E1

Rainfall varies from class C in Region 18 to Class A for one month and class B for two months in post-monsoon period in Region 22. These Regions cover portions of southern States,

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mostly Tamil Nadu, there are also small areas in Andhra Pradesh and Karnataka. Himachal Pradesh has a small pocket which is included in Region 18. The other area in Region 18 comprises of two taluks of dry district of Chitradurga in Karnataka and it accounts for 96 per cent of the cropped area of the Region. Millets, cotton and other pulses are important crops of this Region. Rainfall is 10-11 cm in October, 9-10 cm in September, 5 cm in November and 5-8 cm pm in August and May. Rainfall is very low and the yields of all crops are also low.

14.6.65 Region 19 is entirely in Tamil Nadu and is the biggest with 1.34 per cent cropped area. Rainfall is 10-20 cm pm during October and November. September rainfall is 5-10 cm. It has paddy, jowar, bajra and cotton as main crops. Paddy is entirely irrigated.

14.6.66 Regions 20 to 22 cover areas on the east coast of Tamil Nadu and Andhra Pradesh. Total cropped area is small being less than 0.2 per cent. Rainfall is heavier attaining A and B class in one or two months. Paddy is the main crop and mostly grown under irrigation. Jowar and other pulses are also important.

14.6.67 The cropping patterns of the Regions 18 to 22 together with names of the States included in the Regions are as follows:

	Region - 18	Region-19	Region-20	Region-21	Region-22
rainfall pattern	E4(E4)C1 E3	E4 (E4) C2 E2	E4(E4)B1 C2 E1	E4(E4)E2 C1 E1	E4(E4) A1 **B2** E1
expanded form	O C1	O C2	O C1 B1 C1	OB2 C1	OB2
cropping patterns	i) C4 Mt4 Jr4 Jk4 Pu4 B4 ii) Pu4 Jk4 Mt4 B4 iii) Ba3 Mt4/Mt4/Mt4 iv) Mt3 Ba4	i) Pd1 ii) Pd2 R4/Mt4 iii) Pd3 B4 C4/Mt4 C4/Mt4 L4 iv) Pd4 Gn4 Jk4 B4 R4/C4/Jr5 v) Pd4 Gn4 Mt4 Jk4 Jr4 B4 C4 vi) Jk3 C4 Pu4/Pur Gn4 vii) Jk4 Pd4 Mt4 Gn4 C4/Jr4 viii) Jr3 Pd4 Mt4 Pu4 ix) Jr4 Pd4 Jk4 B4 Pu4 x) B3 C4 Mt4 xi) B3 Jk4 O4 xii) B4 Jk4 Mt4 Gn4 Jr4 xiii) C3 B4 Mt4/Pd4/F4 xiv) C4 Mt4 Pd4 Pu4 Jk4 Gn4 Jk4 Pu4 B4	i) Pd1 ii) Pd3 S4 Pu4 G4 iii) Pd3 Mt4 B4 L4	i) Pd1 ii) Pd2 Jr4/B4 iii) Pd3 Jr4 Pu4 iv) Jr3 Pd4 Pu4	Pd1
States with number of taluks	Karnataka(2) Himachal Pradesh (4)	Tamil Nadu(29)	Tamil Nadu(5)	Andhra Pradesh(5)	Tamil Nadu(2)
area covered as percentage of all India	0.09	1.34	0.12	0.14	0.08

14.6.68 Patterns begin with paddy, cotton, jowar or millets. There is one pattern with fruits, plantation crops and potato which is in Himachal Pradesh. Paddy yields are high. Yields of millets are very good in Tamil Nadu and moderate in Andhra Pradesh. Pulse yields are low. The reasons for the same are required to be looked into and improvement brought about.

Group V: Rainy season from September for two to four months

14.6.69 Regions 23-26: The following four regions have been considered in this group.

Region 23 - E4 (C1 E3) C1 E3
Region 24 - E4 (C1 E3) C2 E2
Region 25 - E4 (C1 E3) B2 E2
Region 26 - E4 (C1 E3) A1 B1 C1 E1

More than 10 cm pm of rainfall is received from September onwards for two to four months. While it is for two months in Region 23, it is 3-4 months in Regions 24-26. In Regions 25-26 which are small areas, rainfall is higher than 20 cm pm for two months. These Regions are in the States of Andhra Pradesh, Tamil Nadu and Karnataka. Cropping patterns of the Regions are given in paragraph 14.6.73. Paddy is the major crop covering more than 50 per cent in regions 25 and 26; groundnut and millets are the other crops. In Kovur taluk of Nellore district, 89 per cent of the cropped area is under paddy.

14.6.70 Regions 23 and 24 are larger in area. The main crops of region 23 are groundnut, ragi and other millets; paddy also has two patterns. Other pulses do not cover large areas but in one pattern the area comparatively higher than the rest. Plantation crops are important in Chikmagalur taluk in Karnataka along with ragi and paddy. As only the eastern half of this taluk is included, the area under plantations is likely to be less. Six of the 12 patterns of region 24 begin with paddy, three with groundnut and the rest with jowar (kharif), jowar (rabi) and tur. Two patterns are with jowar, one kharif and the other rabi.

14.6.71 Paddy predominates in all areas where irrigation is available. Elsewhere millets, groundnut, other pulses and cotton are important. In the more elevated areas of Karnataka ragi predominates. Groundnut also is important. One of the patterns begins with Gn2 i.e. groundnut area is higher than 60 per cent and this is in Vayalpad of Chittoor district. Ragi yield in Karnataka is the same as all-India. Groundnut yield in Andhra Pradesh is the same as all India level but 126 per cent in Tamil Nadu. Rainfall distribution is good for millets, groundnut and cotton in regions 24 to 26 which have not less than three months of 10-20 cm pm.

14.6.72 Paddy can be grown only with irrigation in these Regions which is being done. Conditions are nearly favourable for maize in Regions 25 and 26. Introduction of this crop along with soyabean is worth examining. Measures required to be taken to increase the yield levels of the existing crops also need examination.

14.6.73 Cropping petterns of Regions 23 to 26 are as follows:

	Region 23	Region 24	Region 25	Region 26
expanded form of rainfall	S C2	S C3	S C1 B2	S C1 B1 A1 C1
distribution ~~of~~ cropping patterns	i) Gn2 B4	i) Pd1	i) Pd1	i) Pd1
	ii) Gn4 Mt4 Pu4 Pd4	ii) Pd3 Gn3	ii) Pd2 Jr4	ii) Pd2 Gn4
	iii) Gn4 Pu4 R4 B4 S4 Pd4 Jk4	iii) Pd3 Jk4 B4	iii) Jr4 Mt4 P4 Pu4 R4	
	iv) Mt4 R4 Pu4 Gn4/Jk4	iv) Pd3 B3 R4 F4		
	v) Pd3 R4 Gn4	v) Pd4 Jk4 Gn4/B4		
	vi) Pd4 R4 Jk4 Pu4/Gn4	vi) Pd4 Jr4 B4 Gn4 T4 Mt4		
	vii) Pu4 Mt4 Pd4 R4 Gn4	vii) Jk4 Mt4 B4/C4/B4 Pu4 R4/Pd4 Pu4		
	viii) L3 Pd3	viii) Gn2 Pu4 /Pd4/B4		
	ix) C4 Jk4 Mt4 Jr4/Pu4	ix) Gn3 Pd4 R4/B4		
	x) R3 Gn4 Pd4	x) Gn3 Jk4 Mt4 L4		
	xi) R3 Pu4 L4/Pd4/Gn4	xi) Jr4 Mt4 Pd4 To4 F4		
	xii) R4 Pu4 Jk4 L4 Pd4/ Gn4 Pd4/L4/Mt4/Mt4 C4	xii) To4 Mt4 Jr4 F4/Pd4 B4		
States with number of taluks	Andhra Pradesh(6) Karnataka(26)	Tamil Nadu(8) Andhra Pradesh (13)	Andhra (3) Pradesh	Tamil Nadu(2) Andhra Pradesh (3)
cropped area as % of all India	0.98	0.86	0.10	0.17

Gro : Rainy season from August
for four or five months

14.6. Regions 27-29: The regions included in this grou ceive rainfall of class C (10 cmpm) and above from Augu wards for 4 or 5 months. There are three Regions in this p with the following rainfall patterns:

Region 27 - E4 (C2 E2) C2 E2
Region 28 - E4 (C2 E2) B1 C2 E1
Region 29 - E4 (C2 E2) A1 E1 C1 E1

Regio is the largest with 1.87 per cent of total cropp rea and covers 61 tauks in three States. The croppi atterns of regions 27 to 29 are given in parag 14.6.76. Regions 28 and 29 are in Tamil Nadu and region in Tamil Nadu, Andhra Pradesh and Karnataka. Paddy e main crop in regions 28 and 29 with ground , bajra, ragi, jowar (kharif) and small millets, as the r crops. Region 27 has five paddy patterns but ragi ar war (Kharif) are major crops. Two patterns begin with gr nut. An important feature of the rainfall is that there a our to five consecutive months from August with ra ll of 10 cm pm or more. In region 29, rainfall is high th 20-30 cm in October and greater than 30 cm in Nove . Rainfall distribution favours millets like jowar, cotton roundnut. Forty percent of the taluks in region 27 are rnataka where ragi predominates and the patterns begin wi R2 and R3; the other crops are other pulses, paddy and small millets. Ragi yield in Karnataka is of the order of all-India yield. The two patterns with Gn3 are mainly of Andhra Pradesh, though it is an important crop in the other Regions also. Paddy is grown almost entirely under irrigation with good yields. These are clearly millet Regions and also suitable for cotton and groundnut.

14.6.75 There are possibilities of diverting areas from crops like paddy to protein yielding and fodder crops which may be examined along with the possibilities of increasing yield levels of existing crops.

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14.6.76 Cropping Patterns of the Regions 27 to 29 in Group VI are as follows.

	Region 27	Region 28	Region 29
expanded form of rainfall distribution	A4C4	Au C3 B1 C1	Au C2 B1 A1 C1
cropping patterns	i) Pd1	i) Pd1	i) Pd1
	ii) Pd2 Gn4/Gn4/Gn4(Jk4/B4/Mt4/R4/G5)	ii) Pd2 Gn4/ R4	ii) Pd3 Gn B4 R4
	iii) Pd3 Gn3/Gn4/Gn4(Jk4/B4/Mt4/R4/G5)	iii) Pd3 Gn4/ R4	
	iv) Pd3 Mt4 Gn4/Pu4/Jk4/Jk4 Jr4	iv) Pd4 Mt4 Jk4 Gn4/Gn4 B4	
	v) Pd4 Mt4 Gn4 Jk4/S4		
	vi) R2 Pd4/Pu4/Pd4 Mt4/Pu4 Pd4		
	vii) R3 Pu4 Pd4/L4		
	viii) R3 Gn4 Mt4/Mt4 Pd4		
	ix) R3 (Gn5 Pd5)Mt4 Pu4		
	x) R4 Mt4 Pd4 Gn4		
	xi) Jk3 Pd4 Mt4		
	xii) Jk4 C4 Gn4 Pu4 W4/Pd4 Jr4		
	xiii) Jk4 W4 Pu4 Pd4 F4		
	xiv) Gn3 Jk4 C4 To 4		
	xv) Gn3 Pd4 S4/B4/R4/Jk4. Jr4		
	xvi) Mt4 Pu4 Gn4/Jk4/R4 Pd4		
	xvii) G4 Jk4 W4 Gn4		
states with number of taluks	Tamil Nadu (30) Andhra Pradesh (7) Karnataka (24)	Tamil Nadu (17)	Tamil Nadu (5)
cropped area as per cent of all-India	1.87	0.76	0.20

Group VII - Rainy season for four months from July or five months from June and October 10-20 cm pm

14.6.77 Region 30-36: Rainfall is medium to heavy in the Regions included in this group. The patterns are given below:

Region 30 - E4 (C4/C3) C1 E3
Region 31 - E4 (E3 C1) C1 E3
Region 32 - E4 (A1 C3) C1 E3
Region 33 - E4 (A1 B1 C2) C1 E3
Region 34 - E4 (A2 B1 C1) C1 E3
Region 35 - E4 (A2 B2) C1 E3
Region 36 - E4 (A4/A3) C1 E3

A major feature of the rainfall distribution in the regions of this group is that there are four to five consecutive months from July or June with more than 10 cm pm and October is in 10-20 cm class. Regions 30, 31 and 36 have three or more consecutive months of the same class.

This is a large group of seven regions but total cropped area is only 5.5 per cent of all-India. Region 30 is the largest with nearly half the area - 2.61 per cent. The Region covers areas in Karnataka, Andhra Pradesh, Maharashtra and Orissa and a small area in Himachal Pradesh. Three fourth of the taluks of Region 30 are in Andhra Pradesh. Region 35 and most of Region 31 are in Orissa. Region 32 and two thirds of Region 36 are in Maharashtra. The cropping patterns of these regions are given below:

	Region 30	Region 31	Region 32
Rainfall pattern	Jn (C4/C3)0C1	Jn(B4/B3)0C1	Jn C1 A1 C3
Cropping pattern	i) Pd1 ii) Pd2 Pu4/R4/S4/C4/Fb4 iii) Pd3 Pu4 Gn4/Gn4 Fb4 iv) Pd3 Pu4 Gn4 Fr4 Jr4 v) Pd3 Pu4 04 Fr4/B4 vi) Pd3 R4 04/L4/Pu4 vii) Pd4 Jr4 To4 $\frac{\text{Fb4 Pu4}}{\text{Mt4 Fr4}}$ viii) Pd4 Jr4 To4 F4/Mt4 ix) Pd4 Gn4 $\frac{\text{R4 M4 Fb4}}{\text{Mt4 Jk4 Pu4}}$ x) Gn3 Pd4 Fb4/B4 Pu4 xi) Mt4 B4 Pd4 Jk4 Gn4 xii) Jr3 Pu4 Pd4/Gn4 xiii) B 4 Pd4 R4 04 xiv) R3 Pu4 Pd4/L4 xv) W4 Ba4 Mt4 M4/Pt4/Pt4/Pd4	i) Pd1 ii) Pd2 Pu4/R4/Fb4/G4 iii) Pd3 $\frac{\text{Pu3}}{\frac{\text{Pu4(R4/Mt4/Gn4)}}{\text{Gn4 Fb4}}}$ iv) Pd4 Pu4 04 Mt4/R4	i) Pd2 Jr4 ii) Pd3 R4 Jr4 Mt4 iii) Pd3 Gn4 Jk4 $\frac{\text{Mt4}}{\text{S4}}$ iv) B3 Jr3 v) B3 Jr4 Pd4 vi) Gn4 Jk4 Jr4 vii) Gn4 Jk4 Pd4 $\frac{\text{S4}}{\text{Mt4}}$
States with number of taluks	Andhra Pradesh 57 Karnataka 14 Orissa 1 Himachal Pradesh 2 74	Orissa 25 Andhra Pradesh 4 29	Maharashtra 12
Cropped area as per cent of all-India	2.61	0.88	0.35

	Region 33	Region 34	Region 35	Region 36
Rainfall pattern	Jn C1 A1 B1 C2	Jn B1 A2 C2	Jn B1 A2 B1 C1	Jn (A4/A3)0C1
Cropping pattern	i) Pd1 ii) Pd3 R4 04/Mt4 iii) Pd4 R4 Pu4 Jk4	i) Pd2 L4 ii) W3 M3 Pd4	i) Pd1 ii) Pd2 Pu4/G4/ Pu4 G4	i) Pd1 ii) Pd2 R4/Mt4/ Fr4/Pu4/L4/3 iii) Pd3 R4 Mt4/ M4 04 iv) Pd3 Fr4 L4
States with number of taluks	Karnataka 4 Andhra Pradesh 1 } 5	Himachal Pradesh 6 Karnataka 1 } 7	Orissa 24	Maharastha 41 Karnataka 20 Orrisa 3 } 64
Cropped area as per cent of all-India	0.10	0.05	0.89	0.75

14.6.78 All patterns of regions 31, 33, 35 and 36 begin with paddy and the coverage is more than 50 per cent in many taluks. Region 36 has A type rainfall and is well suited for paddy; the general yield level in coastal Karnataka and coastal Maharashtra is well above all-India. Region 35 has two months of A and near favourable conditions while 31 and 33 have mostly B type; the conditions are not favourable for growing paddy without supplemental irrigation. The yields in Orissa are not high being only 85 per cent of all-India level.

14.6.79 Paddy dominates whether rainfall is sufficient or not. The only good feature is that it is grown mostly under irrigation and yields are high. It may, however, be necessary to consider as to whether available water could be better utilised for raising other crops on larger areas with advantage. The suggestion especially applies to Regions 30 and 31, where the rainfall is good for raising crops like jowar, ragi, etc. Maize can be a good crop for these regions and may be tried. Similarly soybean and cotton can be good crops in Regions 31 to 36. Plantation crops should also be considered especially in Regions 33 to 36. Since there is rainfall in October in addition to monsoon months, possibilities of raising pulses and fodder crops in paddy follows with supplemental irrigation is worth considering.

Group VIII: Rainy season from May for five to seven months

14.6.80 Regions 37, 41, 42, 44, 45, 47-49 and 55: Regions getting fairly heavy rainfall right from May for 5 to 7 months are included in this group. Cropping patterns of these regions are given below:

Region 37 - C1 E3 (A4/A3) E4
Region 41 - C1 E3 (B1 C3) C1 E3
Region 42 - C1 E3 (A1 E2 C1) C1 E3
Region 44 - C1 E3 (A2 B2) C1 E3
Region 45 - C1 E3 (A4/A3) C1 E3
Region 47 - C1 E3 (B1 C3) E2 E2
Region 48 - C1 E3 (B3 C1) E4
Region 49 - C1 E3 (A4/A3) B1 C1 E2
Region 55 - B1 E3 (A3 B1) B1 C1 E2

Though rainfall is spread over five to seven months, Regions 41, 47 and 48 have no month with A type rainfall; in Region 41 there is only one month with type B. rainfall, the rest being C. Region 42 has only one month- July with A, the rest being B or C. Only the remaining regions of this group have three or four months of A during June to September.

14.6.81 The Regions cover areas in the northeast and south and account for 5.6 per cent of the total cropped area. Cropping patterns prevailing in these regions are as follows:

Region No.	Area in	Cropping pattern
45	Karnataka	Pd1, L2pd3, L3Pd3
49	Karnataka, Kerala	Pd1, Pd2 L4, Pd3 I3, L2 Pd4
47, 55	Kerala	Pd2 L4, L2 Pd4, L3 Pd3, L3 Ta4
41, 42	Assam	Pd1, Pd2 Ju4/Pu4
44, 37	Assam West Bengal Bihar Orissa	Pd1, Pd2 Ju4/W5 Pu5
48	West Bengal	Pd1, Pd3 Pu4 Ju4/G4/W4

The cropping structure is dominated by paddy, plantations and tapioca in Kerala and Karnataka. Elsewhere paddy and jute predominate with some wheat and other pulses.

14.6.82 The yield levels of paddy in the coastal regions of Kerala and Karnataka are well above all-India. In the northeastern States excepting West Bengal they are less than the all-India level. Yield levels in Bihar and Orissa are 71 per cent and 85 per cent respectively of the all India level while in West Bengal it is higher being 110 per cent.

14.6.83 Rainfall distribution in the northeast is not so favourable for paddy; most of the area has hardly two months of A type of rainfall. Moisture stress in September and floods affect the yields. There is scope for substitution of paddy with maize and similar crops in Regions 41, 44, 47 and 48 unless irrigation support can be provided. Sayabean too can be a good crop for these regions.

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Group IX: Six to eight consecutive months of rainy season from April or March

14.6.84 Regions 56 to 62: Effective rains occur for a period of six to eight months beginning from April or March. There are seven regions (56 to 62) in this group. Rainfall patterns are given below:

Region 56 - B1 C1 E2 (A1 B1 C2) B1 C1 E2
Region 57 - E1 C1 E2 (A2 B1 C1) E4
Region 58 - B1 C1 E2 (A4/A3) A1 B1 E2
Region 59 - B1 C1 E2 (A4/A3) C1 E3
Region 60 - A1 C1 E2 (A4/A3) C1 E3
Region 61 - A1 B1 C1 E1 (A2 B2) C1 E3
Region 62 - A2 C1 E1 (A4) C1 E3

It can be seen that except in Regions 56 and 57 rainfall is more than sufficient for supporting paddy.

14.6.85 The Regions cover a good portion of Assam and Kerala. The cropped/area of the regions is 4.3 per cent of all-India. Rainfall distribution of more than 10 cm pm is generally for 7 to 8 months. Besides, except in two Regions, there are three to five months from June or July with more than 30 cm Rainfall distribution is thus very favourable for growing paddy. A major difficulty faced in Assam is the large frequency of floods and heavy rains which affect considerably production levels. The position is of not very different in Kerala.

14.6.86 cropping patterns of Regions 56 to 62 are as follov

	Region 56	Region 57	Region 58	Region 59	Regions 60-62
Cropping patterns	L3 Ta4/ Ta4 Pd4	Pd1 Pd2 L4/Ju4	L2 Pd4 L3 Pd3/ Ta4 Pd4	Pd1 Pd2 L4/Ju4 Pd3 L3 M4	Pd1
States covered	Kerala	Assam	Kerala	Assam and West Bengal	Assam and West Bengal

Paddy is the major crop of the above regions except in Regions 56 and 59 where plantations cover larger areas. Pd1 is the sole pattern of regions 60-62 while Pd1 occurs along with Pd2 etc. in the other regions. Plantations(excluding coconuts) are found in the more elevated locations and paddy in low-lying areas. In Kerala coconut plantations are developed on a large scale, covering 20 to 25 per cent of cropped area. Jute figures significantly only in a few areas in Assam.

14.6.87 Cropping structure appears to be satisfactory. In regions 56-57 paddy could be replaced in high lying areas with maize and soyabean with advantage. Possibilities of taking short duration pulses, oilseeds, fodder crops and vegetables appear to be feasible before and after paddy. The high lying areas where raising of plantation crops is difficult could be used for developing grasslands. These regions are generally good for production forestry and plantation crops. Tendency of opening up slopy lands for arable crops has to be discouraged.

Group X: Two rainy seasons

14.6.88 Regions 38-40: This group has two subgroups. In one subgroup the first rainy season is in May with 10-20 cm and the second from August, September or October for three months, two months and one month respectively, all of them being in class 10-20 cm pm. Regions 38-40 come under this sub-group and their rainfall patterns are as follows:

Region 38 - C1 E3(E4) C1 E3
Region 39 - C1 E3 (C1 E3) C1 E3
Region 40 - C1 E3 (C2 E2) C1 E3

These cover areas mostly in Tamil Nadu and Karnataka and a small area in Himachal Pradesh. The cropping patterns of these regions are shown below:

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The cropping patterns of Regions 38 to 40 Group V(a) are as follows:

	Region 38	Region 39	Region 40
Rainfall pattern	My Cl - Cl	My Cl - SC2	My Cl - Au C3
cropping pattern	i) Jk4 Pu4 $\frac{\text{Gn4}}{\text{R5Gn5Pd5}}$ ii) Mtl	i) Pd3 R4 Pu4 ii) Pd4 R4 Pu4 $\frac{\text{S4}}{\text{Jk4}}$ iii) R2 Pd4 iv) R3 Pu4 Pd4/L4/ Jk4/Pd4/Jk4/O4 v) L3 R3 vi) Jk4 R4 Gn4 Pd4/Pu4	i) Pu4 Mt4 Jk4 $\frac{\text{Pd4 Gn4}}{\text{R4}}$ ii) R4 Jk4 Pu4 Gn4 iii) Gn3 Pd4 Jk4/B4/R4 iv) Gn4 Pd4 Jk4 $\frac{\text{Mt4 (Pu4/Jr4)}}{\text{B4 Jr4}}$
States covered	Karnataka 2 Himachal Pradesh 1	Tamilnadu 2 Karnataka 21	Tamilnadu 9 Karnataka 6
cropped area as percent of all-India	0.08	0.65	0.50

14.6.89 In Region 40, rainfall of 10-20 cm pm is for three months from August. The crops grown are millets, other pulses groundnut and paddy. Rainfall distribution is suitable for crops like millets and groundnut. Paddy is grown under irrigation in Region 39 as rainfall of 10-20 cm pm is only for two months from September and August is closer to 10 cm. The Region is mostly in Karnataka where millet yields are good. The Region is nearly suitable for millets and groundnut. Region 38 is small in area and rainfall too is scanty; 10-20 cm pm is received in May and October. August-September are in 5-10 cm pm class. Main crops grown are millets and other pulses. Only Region 40 is satisfactory from the point of view of rainfall for millet crops. Region 39 is nearly so but 38 receives low rainfall and needs to be supported with irrigation.

14.6.90 These regions belong to scanty rainfall tract where long breaks occur during the rainy season. It is, therefore, necessary to examine possibilities of putting larger areas under grasses and economic tree crops which can stand prolonged drought better than arable crops.

14.6.91 Regions 43, 46 and 50-53: The other subgroup X(b) of this group includes six Regions. Their rainfall patterns are as follows:

Region 43 - C1 E3 (A2 C1 E1) C1 E3
Region 46 - C1 E3 (B1 C2 E1) C2 E2
Region 50 - C2 E2 (C2 E2) C1 E3
Region 51 - C2 E2 (B2 C1 E1) C1 E3
Region 52 - C2 E2 (A2 C1 E1) C1 E3
Region 53 - C2 E2 (A2 B1 C1) C2 E2

The two rainy seasons are (a) from January for two to three months, and (b) from July for two to four months except in Region 53 where it is for five months from June. The Regions are in Himachal Pradesh and Jammu & Kashmir and their cropped areas are very small 0.02 to 0.07 per cent of all-India. Together, they total to 0.23 per cent only. The main crops are maize and wheat but barley, paddy and small millets are important in a few taluks. The cropping patterns of the Regions are as follows:

Region 43	Region 46	Region 50	Region 51	Region 52	Region 53
M3W3	M2 W4	i) M1	M1	i) M1	i) W3Pd3M4
		ii) M3 W4 Ba4/ Mt4		ii) M2W3	ii) M3W3Ba4
		iii) Mt3 Ba4 W4			
		iv) W4 M4 Mt4/ Ba4 Pd4			

14.6.92 In Region 50, only July and August get 10-20 cm pm; Region 46 is better with 20-30 cm in July, and August to October in 10-20 cm class. Regions 43 and 52 have July and August with greater than 30 cm pm and 10-20 cm pm in September. Region 53 rainfall is better with July and August greater than 30 cm pm, September 20-30 cm and 10-20 cm pm in June and October. Most of the regions are suitable for a crop like maize and Region 53 is nearly so, even for paddy. Maize yield in Jammu & Kashmir is 80 per cent while in Himachal Pradesh it is very good with State average of 161 per cent of all-India level. Barley yield level is only half of all-India in Jammu & Kashmir while it is 121 per cent in Himachal Pradesh. Paddy being almost entirely irrigated in the northern districts of Jammu & Kashmir has high yields but in the southern districts the yield varies between

60 to 90 per cent of all-India level. Rice yields in Himachal Pradesh are 90 to 100 per cent and wheat 70 per cent of all-India level.

14.6.93 Cropping structure in general appears to be appropria With long rainy seasons and milder temperature, it would be advisable to pay more attention to fruit crops and grassland development.

Group XI: Rainy season from January for four months

14.6.94 Region 54: There is only one region in this group with rainfall pattern C3 E1 (E4) C1 E3. Rainfall is of the order of 10-20 cm pm for four months from January onwards. The precipitation will naturally be in the form of snow and has no direct significance from crop growing point of view. This region is entirely in Jammu and Kashmir with 11 taluks, cropped area being 0.12 per cent of all-India. The cropping patterns are as follows:

i) Pd2 M4
ii) Pd3 M3/M4 (W4/Pu4)
iii) M1 W4 Ba4
iv) M3 W4 Ba4
v) M3 Mt4 Ba4/W4

Paddy and maize are the main crops with significant areas unde wheat and barley. Paddy is irrigated and has hence higher yields. Barley yield is low. Wheat yields in the State during recent years are about 80 to 100 per cent of all-India level.

14.6.95 More attention to grassland and fruit crops development may be desirable.

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All India Cropping Patterns

14.6.96 Just as cropping patterns have been drawn up for each State and Region, it is both desirable and necessary to have an idea of the cropping patterns on all-India basis. Such a list would bring into focus the major aspects of the crop structure of the country. Even a cursory examination of the State lists would show that there are many patterns which are common; and this point has to be kept in view while drawing up an all-India list. For example, a crop pattern like Pd1 occurs in several States but when considering for the whole country it would be listed as only one. Similarly, in patterns beginning with Pd2 which too has another crop, it would be more important to emphasise the predominance of paddy area (greater than 50 per cent) and therefore group together all Pd2 patterns into one showing the second crop, which varies, as alternate by oblique lines i.e. Pd2 Jk4/Jr4/Gn4/etc. The emphasis, similarly, on two or three important crops in each cropping pattern has helped group together a number of patterns, the remaining crops in each pattern being shown as alternatives. The cropping patterns in the different States have been analysed on the above lines and a consolidated all-India list drawn up. The total number of all-India cropping patterns is 177 and these are detailed in Appendix 14.6 - Statement VI. The distribution of cropping patterns according to crops and their subscripts 1 to 4 representing area intervals, is shown in Table 14.6. Cereals contribute 72 per cent of the patterns (128 out of 177). The maximum number of 30 is with paddy and jowar crops. Wheat and bajra have ~~20~~ 19 and ~~19~~ 20 patterns respectively. Cotton is the next largest with 16. Groundnut has 9 patterns but

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oilseeds other than groundnut only one. Fruits, tobacco, plantations and fodder have two each but there is none with sugarcane or tur. Pulses have in all fourteen patterns.

Table 14.6

Number of all-India Cropping Patterns
beginning with different crops and subscripts.

Crop	Subscript 1	2	3	4	Total
cereals(128/177)					
Pd	1	1	10	18	30
Jk			6	11	17
Jr	1	1	~~2~~4	7	13
B	1	1	7	11	20
M	1	1	6	4	12
R		1	3	3	7
W		1	9	9	19
Ba		1	1	1	3
Mt	1		3	3	7
pulses (14/177)					
[illegible]			2	5	7
Pu		1	1	5	7
oilseeds (10/177)					
Gn	1	1	3	4	9
O				1	1
cotton (16/177)					
C	1	1	5	9	16
other crops (~~1~~9/177)					
L		1	1		2
F			1	1	2
Fr			1	1	2
Pt			1		1
Ta			1	1	2
total	7	11	65	94	177

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Crop Yields

14.6.97 In the foregoing analysis of the cropping patterns in the various rainfall regions, only a brief and general reference could be made to yield levels of crops and these mostly concerned the State yields. This, however, is not sufficient and a detailed examination of crop performance is both necessary and important while assessing suitability of different crops in the various parts of the country. District averages of yields based on data for three years, mostly 1968-69 to 1970-71, are available for the main crops. The district averages have also been expressed as per cent of all-India and these, which are termed as Relative Yield Index (%) values, are also available. Frequency tables of district Relative Yield Index (RYI) values are given in Tables 14.7 to 14.18 and 14.20 for the following thirteen crops:

> rice, maize, jowar(kharif), jowar (rabi)
> bajra, ragi, small millets, wheat, gram, tur,
> total pulses, groundnut, cotton.

Here, only a preliminary analysis of the district yields has been made using the frequency tables mentioned above. Detailed discussions on crop performance in relation to rainfall distribution and various other aspects are given in Chapters 21, 22 on Foodgrain Crops and Commercial Crops etc. For convenience in reference and use, Statewise and districtwise geographical and gross cropped areas together with districts rainfall patterns are contained in Appendix 14.6 Statements VII and VIII.

Rice

14.6.98 Table 14.7 shows the frequency distribution of district RYI values of rice together with the lowest and highest district RYI in each of the States.

Table 14.7

Frequency Distribution of District Relative Yield Index - Rice

State	Area (thousand ha)	RYI	Number of districts with RYI of						Total number of dis-tricts	District RYI	
			less than or equal to 50	50 to 70	70 to 90	90 to 110	110 to 130	130 to 150	Greater than 150		low-est	high-est
Karnataka	1,127	163	-	-	-	1	3	4	11	19	101	305
Tamil Nadu	2,585	159	-	-	-	1	1	1	10	13	92	202
Punjab	362	141	-	-	-	1	3	5	2	11	102	162
Jammu & Kashmir	236	141	-	2	2	2	1	-	2	9	58	204
Kerala	874	132	-	-	-	1	4	4	1	10	94	161
Haryana	246	125	-	-	-	2	2	2	-	6	94	142
Andhra Pradesh	3,238	118	-	-	2	4	6	4	2	18	83	157
West Bengal	4,939	111	-	-	3	6	3	3	-	15	83	144
Himachal Pradesh	99	103	-	-	2	6	-	-	-	8	88	108
Maharashtra	1,336	99	8	4	5	5	1	3	-	26	37	138
Assam	2,059	92	-	-	3	4	1	-	-	8	72	130
Orissa	4,258	85	-	1	9	3	-	-	-	13	70	94
Gujarat	488	79	1	9	3	3	-	-	-	16	34	109
Rajasthan	121	73	4	1	2	1	-	-	1	9	36	157
Madhya Pradesh	4,350	72	18	6	9	5	-	-	-	38	33	106
Bihar	5,280	71	1	8	5	3	-	-	-	17	45	165
Uttar Pradesh	4,336	70	4	19	20	5	1	-	-	49	45	119
total			36	50	65	53	26	26	29	285		
per cent of total			13	18	23	18	9	9	10			

About half of the total number of districts have yields less than 90 per cent of all-India and as many as 31 per cent of the district yields are less than 70 per cent of all-India. Only 10 per cent of the districts have yields exceeding 150 per cent of all-India and these are confined to Tamil Nadu, Karnataka and a few from Punjab, Jammu and Kashmir and Andhra Pradesh. It should also be mentioned that during the past few years Punjab and Haryana State yields have risen considerably and along with Tamil Nadu are among the highest in the country; the crop in these States is almost entirely irrigated. A major feature is the high frequency of low yields in the States of Orissa, Bihar, Uttar Pradesh and Madhya Pradesh. Out of 117 district yields in these four States, 57 are less than 70 per cent of all-India and 43 are between 70 and 90 per cent of all-India. As these four States have about 60 per cent of total area under rice in the country, the low yields have affected the all-India average which for the period 1968-69 to 1970-71 is just 10.9 q/ha. The high yields are associated with irrigated areas.

14.6.99 Maize: Frequency distribution of district RYI of maize is given in Table 14.9. Of the 227 district where maize is grown 62 yields are less than 70 per cent of all-India and 126 (55 per cent of total) less than 90 per cent. Karnataka yields are the best in the country and they range between two to four times of all-India. Twenty two per cent of the yields exceed 110 per cent of all-India. In many of the States the yields are low. The all-India average is only 10.8 q/ha, almost the same as rice.

Table 14.8

Frequency Distribution of District Relative Yield Index - Maize

State	Area (thousand ha)	RYI	Number of districts with RYI of: less than or equal to 50	50 to 70	70 to 90	90 to 110	110 to 130	130 to 150	Greater than 150	Total number of districts	District RYI: lowest	highest
Karnataka	59	262	-	-	-	-	-	-	8	8	203	371
Himachal Pradesh	256	161	-	-	-	-	1	3	4	8	123	253
Punjab	523	138	-	-	-	1	4	5	1	11	97	195
Andhra Pradesh	244	111	-	-	4	8	8	-	1	21	74	170
Tamil Nadu	14	100	-	-	-	8	1	-	-	9	93	123
Haryana	104	98	-	1	2	2	1	-	-	6	69	117
Gujarat	280	97	-	-	3	4	-	-	-	7	87	109
Jammu & Kashmir	251	91	-	1	4	3	-	1	-	9	65	133
Bihar	956	90	1	4	9	1	2	-	-	17	39	120
Uttar Pradesh	1,475	89	-	11	17	9	6	1	-	44	50	139
Orissa	69	77	1	3	5	1	-	1	-	11	49	131
Rajasthan	778	74	1	8	6	1	-	-	-	16	45	100
Maharashtra	44	72	7	6	5	2	-	1	1	22	34	161
Madhya Pradesh	587	71	2	12	9	9	2	-	-	34	46	117
Assam	27	50	1	3	-	-	-	-	-	4	46	58
total			13	49	64	49	25	12	15	227		
per cent of total			6	21	28	22	11	5	7			

14.6.100 Jowar(kharif): Frequency of district yields is shown in Table 14.9. Maharashtra and Madhya Pradesh together account for 43 per cent of total area under this crop in the country; more than 50 per cent of the districts in these States have yields exceeding 110 per cent of all-India. Karnataka and Tamil Nadu yields are well above all-India. Lowest yields of less than 50 per cent are in parts of Uttar Pradesh, Rajasthan, Haryana and Gujarat and these may be due partly to the crop being grown for fodder purposes. Forty six per cent of the district yields in the country are above 110 per cent of all-India and about 25 per cent less than 70 per cent of all-India. In a number of districts in Karnataka which has a State average of 170 per cent of all-India, yields have exceeded two to three times of all-India.

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Table 14.9

Frequency Distribution of District Relative Yield Index - Jowar(Kharif)

State	Area (thousand ha)	RYI	Number of districts with RYI of							Total number of districts	District RYI	
			less than or equal to 50	50 to 70	70 to 90	90 to 110	110 to 130	130 to 150	Greater than 150		lowest	highest
Karnataka	1,528	172	.			1	2	2	11	16	110	358
Orissa	16	140	..		.	1		1	1	3	109	281
Tamil Nadu	553	136	-		.		4	4	4	12	113	212
Uttar Pradesh	760	118	4	3	3	6	5	4	12	37	31	267
Madhya Pradesh	2,263	115	..	1	5	7	12	6	8	39	62	159
Maharashtra	2,406	107	-	1	8	7	2	1	4	23	64	155
Andhra Pradesh	1,293	89	..	4	8	4	5	..		21	51	128
Kerala	1	85		.	1	-	.	.	..	1	85	85
Rajasthan	1,089	71	7	4	3	1	2	-	-	17	19	116
Gujarat	1,134	43	8	9			1	-	..	18	15	118
Haryana	216	42	6	..		-	-	.	.	6	34	47
total			25	22	28	27	33	18	40	193		
per cent of total			13	11	15	14	17	9	21			

14.6.101 Jowar(rabi): Jowar (rabi) is confined mostly to the southern States. The largest area is in Maharashtra but the yields are generally low; only 4 of the 19 district yields are above 90 per cent of all-India. Karnataka yields are better. The all-India average is less than 5 q/ha. Frequency distribution of district RYI values of jowar (rabi) together with the lowest and highest district RYI values in each State is given in Table 14.10.

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Table 14.10

Frequency Distribution of District Relative Yield Index - Jowar (Rabi)

State	Area (thousand ha)	RYI	Number of districts with RYI of							Total number of districts	District RYI	
			less than or equal to 50	50 to 70	70 to 90	90 to 110	110 to 130	130 to 150	Greater than 150		lowest	highest
Gujarat	180	172		.	.	.	-	1	11	12	150	206
Tamil Nadu	172	170			.	..	-	2	9	11	140	266
Madhya Pradesh	24	140		-	-		1	..	2	3	127	185
Karnataka	1,528	116	.		1	2	2	1	3	9	83	238
Andhra Pradesh	1,339	94		2	5	11	3	..	.	21	55	128
Maharashtra	3,237	80	1	5	5	4	3	..	1	19	50	156
total			1	7	11	17	9	4	26	75		
per cent of total			1	9	15	23	12	5	35			

14.6.102 Bajra: Table 14.11 shows the frequency distribution of district yields in the different States. The all-India average yield is only 4.6 q/ha and the district yields show a wide range from 15 per cent of all-India in parts of Rajasthan to about 260 per cent in Gujarat, Uttar Pradesh and Punjab. The average yield of the country is on the low side. About 55 per cent of the district yields exceed 110 per cent of all-India and 25 per cent yields are above 150 per cent of all-India. Rajasthan has the largest area of 4.7 Mha with State average of 61 per cent of all-India and yield levels in out of 19 districts are less than 50 per cent, Maharashtra with the next largest area of 2 Mha has also similar low yield levels; 5 out of 20 district yields are less than 50 per cent. Only Gujarat with a large area of 1.7 Mha has good yield distribution, 15 out of 17 districts being above 110 per cent. In Tamil Nadu area is not large, (0.47 Mha) but 11 of the twelve district yields are above 110 per cent.

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Table 14.11

Frequency Distribution of District Relative Yield Index - Bajra

State	Area (thousand ha)	RYI	Number of districts with RYI of: less than or equal to 50	50 to 70	70 to 90	90 to 110	110 to 130	130 to 150	Greater than 150	Total number of districts	District RYI: low-est	high-est
Punjab	198	239	-	-	-	1	-	1	7	9	109	261
Uttar Pradesh	1,063	149	1	2	5	2	5	10	15	40	47	264
Gujarat	1,694	147	-	1	1	-	3	1	11	17	65	255
Tamil Nadu	462	143	-	-	-	1	4	4	3	12	108	167
Haryana	895	128	-	-	1	-	-	3	3	7	73	162
Madhya Pradesh	232	118	-	2	5	2	-	2	1	12	58	173
Jammu & Kashmir	16	115	-	-	-	-	2	-	-	2	114	124
Andhra Pradesh	606	104	-	6	4	1	5	1	3	20	55	211
Karnataka	516	88	-	1	3	2	4	-	-	10	67	120
Maharashtra	2,029	77	5	6	6	2	1	-	-	20	27	111
Rajasthan	4,670	61	7	2	5	2	1	2	-	19	15	145
total			13	20	30	13	25	24	43	168		
per cent of total			8	12	18	8	15	14	25			

14.6.103 **Ragi:** Table 14.12 shows frequency distribution of district yields of ragi. The all-India average yield is 7.9 q/ha. About half the district yields are less than 90 per cent. The highest of district yields hardly reaches even twice of all-India. Some of the lowest yields are from Andhra Pradesh. Karnataka which has the largest area has all-India yield level.

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Table 14.12

Frequency Distribution of District Relative Yield Index - Ragi

State	Area (thousand ha)	RYI	Number of districts with RYI of less than or equal to 50	50 to 70	70 to 90	90 to 110	110 to 130	130 to 150	Greater than 150	Total number of districts	District RYI low-est	District RYI high-est
Kerala	5	164	-	-	1	1	1	2	3	8	89	212
Tamil Nadu	340	126	-	-	-	4	3	4	1	12	94	186
Orissa	158	110	-	1	3	4	-	-	1	9	60	152
Karnataka	887	99	-	2	2	10	-	-	-	14	64	109
Maharashtra	217	97	-	-	8	3	6	2	-	19	71	143
Uttar Pradesh	237	94	-	-	5	1	-	-	-	6	74	98
Andhra Pradesh	326	92	3	5	3	7	2	1	-	21	17	148
Gujarat	55	91	-	-	1	4	-	-	-	5	81	94
Bihar	178	71	2	5	1	4	1	-	-	13	43	115
total			5	13	24	38	13	9	5	107		
per cent of total			5	12	22	36	12	8	5			

14.6.104 Small millets: Table 14.13 gives the frequency distribution of district yields. The largest area under small millets is in Madhya Pradesh with 1.7 Mha (35 per cent of total) and Andhra Pradesh is next with 0.85 Mha. The average all-India yield is low and only 3.8 q/ha. Thirty one per cent of yields exceed 150 per cent and 50 per cent are above 110 per cent. Although not requiring high rainfall, 30 per cent yields (51 out of 168) are less than 70 per cent. Twentytwo of 29 district yields in Madhya Pradesh, 15 out of 21 in Andhra Pradesh and 9 out of 22 in Maharashtra are less than 70 per cent. It is the low yields in these States that have depressed the all-India average.

Table 14.13

Frequency Distribution of District Relative Yield Index -Small Millets

State	Area (thousand ha)	RYI	Number of districts with RYI of less than or equal to 50	50 to 70	70 to 90	90 to 110	110 to 130	130 to 150	Greater than 150	Total number of districts	District RYI low-est	high-est
Himachal Pradesh	23	226	-	-	-	1	-	-	2	3	107	269
Tamil Nadu	474	199	-	-	-	-	1	5	6	12	129	363
Gujarat	153	188	-	-	-	4	1	-	9	14	92	234
Uttar Pradesh	557	163	-	-	-	-	-	10	19	29	138	207
Kerala	6	139	-	-	-	1	3	2	1	7	104	226
Bihar	228	116	-	1	1	2	1	3	8	16	69	194
Orissa	177	105	-	2	1	1	2	2	2	10	61	155
Maharashtra	205	104	2	7	3	3	3	1	3	22	47	257
Rajasthan	72	77	-	2	1	1	-	-	1	5	50	192
Madhya Pradesh	1,683	62	4	18	6	1	-	-	-	29	36	106
Andhra Pradesh	846	56	9	6	4	1	-	-	1	21	14	160
total			15	36	16	15	11	23	52	168		
per cent of total			9	21	10	9	6	14	31			

14.6.105 **Wheat:** The all-India average yield of wheat is only 12.2 q/ha. The frequency distribution of yields is shown in Table 14.14. High yields are mainly in the Punjab and Haryana with State averages of 181 and 162 per cent of all-India. The highest district yields have not exceeded two and half times of all-India; only Ludhiana has the highest yield of 244 per cent of all-India. There was no other district yield in the country with twice that of all-India though some are close to it in Punjab and Haryana. A major feature is that but for Hoshiarpur district yield of 116 per cent, the rest of the yields in Punjab are higher than 150 per cent and five of the eleven are between 180 and 244 per cent of all-India. The crop is almost entirely irrigated in Punjab and Haryana. It would be both relevant and of interest to mention that West Bengal has taken to wheat cultivation in recent years and though the area is not large (0.3 to 0.4 Mha) the yield levels are close to Haryana and Punjab and more than twice of all-India.

Table 14.14

Frequency Distribution of District Relative Yield Index - Wheat

State	Area (000 hectares)	RYI	Number of districts with RYI of: Less than or equal to 50	50 to 70	70 to 90	90 to 110	110 to 130	130 to 150	Greater than 150	Total number of districts	District RYI: Lowest	Highest
Punjab	2,1[illegible]	181	-	-	-	-	1	-	10	11	116	[illegible]
Haryana	[illegible]	152	-	-	-	-	1	3	3	7	125	191
Gujarat	[illegible]	[illegible]	-	-	1	1	12	2	2	18	73	158
Orissa	[illegible]	102	-	1	3	4	-	-	1	9	52	160
Uttar Pradesh	6,2[illegible]	105	-	-	20	18	8	2	1	49	71	157
Rajasthan	1,[illegible]	95	-	3	6	11	2	1	-	23	58	134
Bihar	1,16[illegible]	73	-	8	7	-	-	-	-	15	64	85
Himachal Pradesh	32[illegible]	[illegible]	-	6	3	-	-	-	-	9	58	88
Madhya Pradesh	3,22[illegible]	[illegible]	10	24	8	1	-	-	-	43	32	[illegible]
Maharashtra	853	[illegible]	17	4	1	-	-	-	-	22	[illegible]	70
Tamil Nadu	1	31	5	-	1	-	-	-	-	6	27	81
Karnataka	313	3[illegible]	6	-	-	-	-	-	-	6	25	31
Andhra Pradesh	14	19	13	-	-	-	-	-	-	13	13	32
Total			51	46	50	35	24	8	17	231		
Per cent of total			22	20	22	15	10	4	7			

14.6.106 Uttar Pradesh has the largest area under wheat of 5.5 Mha followed by Madhya Pradesh with 3.3 Mha; these two States together account for 50 per cent of total cropped area under wheat in the country. In Uttar Pradesh two-thirds of wheat area is irrigated but the yield level is just all-India. Madhya Pradesh yield level is only 57 per cent of all-India, the extent of irrigation being 16 per cent. Bihar and Rajasthan have also large areas of 1.2 ~~to~~ and 1.3 Mha with yields of 73 and 52 per cent of ~~the~~ same ~~order as~~ all-India though the extent of irrigation is 51 and 66 per cent respectively. Of the 43 districts in Madhya Pradesh 10 districts have yields less than 50 per cent and 24 districts between 50 to 70 per cent; the range in yields varying between a low level of 32 per cent to a maximum of 95 per cent.

14.6.107 As may be expected because of the less favourable temperature and other conditions wheat yields in the southern States are very low. These range between 13 to 34 per cent in Karnataka and Andhra Pradesh; Maharashtra is not much better, the State average being only 40 per cent. But for these States the all-India average would be higher.

14.6.108 Gram: The frequency distribution of district yields of gram is shown in Table 14.15. The all-India average yield of gram is 6.7 q/ha and 23 per cent of the district yields are above 110 per cent of all-India. A general feature is the large number of low yields of less than 90 per cent of all-India in almost all the States. Only Punjab and Haryana yields are good with averages of about 130 per cent. Though Uttar Pradesh has a number of districts having low yields, it has also about 60 per cent districts exceeding 110 per cent of all-India and two district yields exceed 150 per cent; the State average being 115 per cent. Fifty two district yields out of 53 in the States of Maharashtra, Andhra Pradesh and Karnataka are less than 70 per cent and in none of these States the yield has exceeded 71 per cent.'

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Table 14.15

Frequency Distribution of District Relative Yield Index - Gram

State	Area (thousand ha)	RYI	Number of Districts with RYI of less than or equal to 50	50 to 70	70 to 90	90 to 110	110 to 130	130 to 150	Greater than 150	Total number of districts	District RYI low-est	District RYI high-est
Haryana	902	131	-	-	1	1	3	-	2	7	87	165
Punjab	349	128	-	-	-	1	4	2	3	10	104	165
Uttar Pradesh	2,163	115	1	2	5	11	14	12	2	47	33	201
Bihar	238	99	-	5	4	4	2	-	-	15	64	128
Rajasthan	1,292	96	-	6	10	2	3	1	-	22	57	133
Gujarat	45	91	-	-	1	5	-	-	-	6	89	105
Himachal Pradesh	18	89	-	-	2	-	-	1	-	3	72	132
Orissa	22	88	-	1	1	1	-	1	-	4	55	136
Tamil Nadu	-	79	-	-	10	1	-	-	-	11	75	105
Madhya Pradesh	1,552	78	2	16	20	4	1	-	-	43	46	121
Karnataka	193	61	1	6	1	-	-	-	-	8	49	71
Maharashtra	357	44	17	7	-	-	-	-	-	24	34	63
Andhra Pradesh	80	39	17	4	-	-	-	-	-	21	13	64
total			38	47	55	30	27	17	7	221		
per cent of total			17	21	25	14	12	8	3			

14.6.109 **Tur:** Table 14.16 gives the frequency distribution of district yields of tur. One third of the district yields are less than 70 per cent and about 25 per cent are more than 130 per cent of all-India. The low yields are largely concentrated in the southern States. The all-India yield is only 7 q/ha.

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Table 14.16

Frequency Distribution of District Relative Yield Index -Tur

State	Area (thousand ha)	RYI	Number of Districts with RYI of: less than or equal to 50	50 to 70	70 to 90	90 to 110	110 to 130	130 to 150	Greater than 150	Total number of districts	District RYI: lowest	District RYI: highest
Uttar Pradesh	597	163	-	-	-	1	6	17	19	43	93	267
Bihar	165	107	1	2	-	4	2	4	2	15	43	190
Madhya Pradesh	489	94	-	4	22	2	4	8	1	41	59	154
Orissa	44	80	-	1	5	1	1	1	-	9	69	139
Karnataka	198	71	-	3	12	-	-	-	1	16	61	201
Maharashtra	627	68	7	5	7	5	1	-	-	25	34	113
Gujarat	90	67	1	3	5	-	-	-	-	9	43	76
Rajasthan	25	57	2	2	1	-	-	-	-	5	45	76
Tamil Nadu	50	57	5	7	-	-	-	-	-	12	46	67
Kerala	5	57	2	3	1	-	-	-	-	6	25	78
Andhra Pradesh	189	50	10	10	1	-	-	-	-	21	27	82
total			28	40	54	13	14	30	23	202		
per cent of total			14	20	27	6	7	15	11			

14.6.110 Total Pulses: Table 14.17 shows the frequency distribution of yields of total pulses. About a fifth of the district yields are less than 50 per cent of all-India level. Low yields are concentrated in ~~Madhya Pradesh,~~ Maharashtra, Gujarat and the southern States. For example, in Andhra Pradesh the yield level of 20 out of 21 districts is less than 50 per cent. Higher yields are mainly in the northern States. Of a total of 66 districts in Uttar Pradesh, Punjab and Haryana, in 46 districts yields exceed 150 per cent of all-India level. Only ~~four~~ five district~~s~~ yields out of ~~50~~ 51 from the other States are as high as 150 per cent.

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Table 14.17

Frequency Distribution of District Relative Yield Index - Total pulses

State	Area (thousand ha)	RYI	Number of Districts with RYI of: less than or equal to 50	50 to 70	70 to 90	90 to 100	110 to 130	130 to 150	Greater than 150	Total number of districts	District RYI: lowest	highest
Haryana	395	162	-	-	-	-	2	-	5	7	119	207
Uttar Pradesh	3,891	162	-	-	-	2	4	9	34	49	110	232
Punjab	405	156	-	-	-	1	1	1	7	10	100	184
Jammu & Kashmir	46	117	1	2	-	-	1	-	2	6	38	220
Bihar	1,654	109	-	1	5	5	5	1	-	17	66	138
Orissa	896	100	-	2	2	5	3	1	-	13	62	142
Madhya Pradesh	4,060	85	4	18	6	1	-	-	-	29	36	106
Himachal Pradesh	62	79	-	3	3	1	-	-	1	8	57	159
Assam	90	73	-	2	4	-	-	-	-	6	63	88
Rajasthan	3,245	71	8	5	3	6	1	1	1	25	10	156
Kerala	42	71	-	5	5	-	-	-	-	10	59	77
Karnataka	n.a.	68	4	9	3	-	1	-	1	18	24	297
Gujarat	422	64	4	4	5	2	-	-	-	15	31	100
Maharashtra	2,637	60	4	14	5	2	-	-	-	25	48	102
Tamil Nadu	377	42	12	1	-	-	-	-	-	13	34	56
Andhra Pradesh	1,446	34	20	1	-	-	-	-	-	21	16	51
total			57	67	41	25	18	13	51	272		
Per cent of total			21	25	15	9	7	5	18			

14.6.iii Groundnut: Table 14.18 shows the frequency distribution of district yields of groundnut. Gujarat has the largest area under groundnut nearly 25 per cent of total, and Andhra Pradesh is next with 20 per cent. Maharashtra, Karnataka and Tamil Nadu, each accounts for 12 to 14 per cent area of area under the crop. The number of district yields exceeding 150 per cent is small or negligible. The yields of 60 per cent of the districts are between 70 to 110 per cent of all-India level. Frequency of high yields of above 110 per cent in States with larger coverage is small except for Tamil Nadu where all yields exceed 100 per cent. A few remarks concerning Gujarat yields may be of interest.

Table 14.18

Frequency Distribution of District Relative Yield Index - Groundnut

State	Area (thousand ha)	RYI	Number of Districts with RYI of							Total number of districts	District RYI	
			less than or equal to 50	50 to 70	70 to 90	90 to 110	110 to 130	130 to 150	Greater than 150		lowest	highest
Kerala	14	197							1	1	107	197
Orissa	71	160				1	2	4	3	10	101	263
Tamil Nadu	955	126					9	3		12	116	134
Punjab	201	124				2	5	2		9	100	149
Andhra Pradesh	1,362	103			8	8	1	3	1	21	81	152
Haryana	13	99								1	98	98
Uttar Pradesh	348	96			11	5	5		-	21	71	117
Gujarat	1,768	96	1	1	8	5	1	1		17	44	137
Karnataka	826	92		1	3	6	1	4	1	16	57	160
Maharashtra	926	91		2	14	3	2	3		24	55	144
Madhya Pradesh	456	85		1	15	5	1			22	64	113
Rajasthan	237	56	2	6	2	1		-		11	27	96
total			3	11	61	37	27	20	6	165		
per cent of total			2	7	37	22	16	12	4			

Table 14.19 shows the yields during the five years 1967-68 to 1971-72 for the main States.

Table 14.19

Groundnut yields (q/ha)

State	1967-68	1968-69	1969-70	1970-71	1971-72
Gujarat	7.3	4.5	6.3	10.4	8.7
Maharashtra	7.1	7.1	6.5	6.5	6.2
Karnataka	5.4	6.9	6.1	7.3	7.3
Andhra Pradesh	7.6	7.5	7.7	7.7	7.6
Tamil Nadu	9.7	8.3	8.5	9.7	9.2
all-India	7.6	6.5	7.2	8.3	7.9

In Tamil Nadu and Andhra Pradesh the crop is about 13 per cent irrigated. Gujarat shows large variations while the other State yields are more stable. The high variability of rainfall in Saurashtra (Gujarat) where the crop is concentrated, could be a significant contributory factor to large fluctuations.

14.6.112 Cotton: The frequency distribution of district yields of cotton is given in Table 14.20. A good feature is that a third of the yields exceed 150 per cent of all-India. Of the 45 yields in this group, 24 are from Punjab, Haryana and Tamil Nadu where the crop is almost entirely irrigated and 13 from Gujarat, where it is mostly rainfed and irrigated area is about 15 per cent. The highest yields recorded are 3.4 ~~to~~ an 3.5 times of all-India and these are from Punjab and Tamil Nadu. Another equally important feature is the large percentage (41) of low yields of less than 90 per cent of all-India concentrated in the States of Madhya Pradesh, Maharashtra, Andhra Pradesh and Karnataka, where the crop is almost entirely rainfed. Thirteen of the 21 very low yields of less than 50 per cent are from Andhra Pradesh. Maharashtra has the largest area under cotton in the country but its yield level is hardly half of all-India. The various problems connected with rainfed and irrigated areas have been considered in detail in Chapter 22 on Commercial Crops.

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Table 14.20

Frequency Distribution of District Relative Yield Index - Cotton

State	Area (thousand ha)	RYI	Number of Districts with RYI of: less than or equal to 50	50 to 70	70 to 90	90 to 110	110 to 130	130 to 150	Greater than 150	Total number of districts	District RYI: low-est	high-est
Punjab	397	305	-	-	-	1	-	-	10	11	97	337
Haryana	300	263	-	-	-	-	-	1	5	6	138	293
Tamil Nadu	313	164	-	1	2	-	-	-	9	12	66	352
Gujarat	1,612	144	-	-	1	-	2	2	13	18	85	204
Uttar Pradesh	51	131	-	-	-	-	6	-	2	8	115	196
Rajasthan	241	111	-	1	1	4	2	1	-	9	70	132
Kerala	7	92	-	-	-	1	-	-	2	3	91	243
Madhya Pradesh	688	65	1	11	3	-	-	-	-	15	40	86
Maharashtra	2,777	56	5	10	-	2	-	1	3	21	42	221
Karnataka	1,021	53	2	8	-	-	-	-	-	10	33	60
Andhra Pradesh	316	45	13	4	1	1	-	-	1	20	15	231
total			21	35	8	9	10	5	45	133		
per cent of total			16	26	6	7	7	4	34			

14.6.113 In paragraphs 14.6.98 to 14.6.112, yields have been analysed for each crop individually. To obtain a broad idea of the performance of crops in each of the States, it would be necessary to specify a limit for crop yield as satisfactory. Average yields exceeding 110 per cent of all-India could be regarded as a satisfactory base for a preliminary general survey. Table 14.21 gives the percentage of district average yields exceeding 110 per cent of all-India for the various crops in different States. In Punjab and Haryana with a high percentage of irrigation the percentage share of RYI values exceeding 110 per cent of all-India is good for most of the crops. Tamil Nadu is nearly similar except for wheat and pulses. Among rainfed States, Gujarat yields seem very satisfying for a number of important crops. In many of the States yields are high for a few individual crops.

Table 14.21

Percentage of Districts in each State having RYI Values Exceeding 110 - Cropwise

State	Pd	M	Jk	Jr	B	R	Mt	W	G	T	Total pulses	Gn	C
Assam	13	0									0		
West Bengal	40												
Orissa	0	0				11	60	11	25	22	31	90	
Bihar	0	0				8	75	0	13	53	35		
Uttar Pradesh	2	16	57		75	0	100	22	60	98	96	44	100
Himachal Pradesh	0	100					67	0	33		13		
Jammu and Kashmir	33	11			100						50		
Punjab	91	91			90			100	90		90	78	91
Haryana	67	17	0		86			100	70		100	0	100
Rajasthan	11	0	12		16	0	20	13	18	0	12		33
Gujarat	0	0	6	100	90		64	78	0	0	0	12	94
Madhya Pradesh	0	6	67	100	25		0	0	2	32	0	0	0
Maharashtra	15	9	30	21	5	42	32	0	0	4	0	21	19
Andhra Pradesh	67	43	24	14	45	14	5	0	0	0	0	24	5
Karnataka	95	100	94	67	40	0		0	0	6	11	37	0
Tamil Nadu	92	11	100	100	92	67	100	0	0	0	0	100	75
Kerala	90		0			75	85			0	0	100	67

State Cropping Patterns

14.6.114 Working papers were prepared in the Commission on Rainfall and Cropping Patterns of the various States and discussed with the respective State authorities. The following points were raised in the course of discussions:-

i) Are existing cropping patterns efficient from agronomic as well as economic point of view?

ii) If change is necessary, which are the areas where changes should be made?

iii) In the case of existing cropping patterns being acceptable at some places, what is the scope for increasing productivity and how is this to be achieved?

iv) In areas where change is considered necessary, what are the recommendations regarding substitute crops? The changes may be indicated separately for rainfed and irrigated conditions taking into consideration the soil factor also.

An idea of the scope and extent of the working papers on Rainfall and Cropping Patterns of the different States may be had from the abridged sample of Karnataka State Report given in Appendix 14.9. In a number of States, Committees of experts drawn from the various concerned departments and local agricultural university were constituted to consider the points which emerged from a discussion of the Working Papers. Five States, Karnataka, Kerala, Maharashtra, Assam and Orissa have made available to us their remarks and comments and these are briefly summarised in the succeeding paragraphs.

14.6.115 Orissa: The State has suggested cropping patterns for four types of land on the basis of topography viz., very-high, high, medium and low lands for the rainfed areas and for high, medium and low for irrigated areas. In the existing cropping patterns, paddy is the major crop and often Pd1 or Pd2. They have proposed a number of changes. For example, in the case of Jaleswar (Balasore district) while Pd1 is the existing cropping pattern, the suggested crops[1] are as follows:-

Rainfed areas	
high land	Pd - W/O/Gn Fb - W/O/Gn
medium land	Pd - Pu/O Fb - Pu/O Fb - Pu/O Fb - Pd - O/Pd
low land	Pd - Pu/O Fb - Pd - O/Pu
Irrigated areas	
high land	Pd - P/V/W - Pu/O
medium land	Fd - Pd Fb - Pd - Pu/O Fd - Gn/Pu - O
low land	Pd - Pd Fb - Pd - Pd Fb - Pd - Pu/O/V.

14.6.116 Kerala: There are considerable variations in topography in the State. Plantations and paddy are the main crops with some tapioca. In drawing up the recommended patterns, they have been given separately for valley, slope and hill top areas. In the first area (which covers Onattukara) their suggestions are:

valley	
autumn (virippu)	rice
winter (mundakan)	rice
summer (punja)	sesamum, cowpea, vegetable, cucurbits
slope	
perennial	coconut
intercrops	groundnut, rice, pulses (cowpea, green gram, black gram) banana, tapioca and tuber crops, foddergrass
hill top	only raised garden lands.

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[1] Orissa Government's report on rainfall and cropping patterns forms Appendix 14.8 - Statement I.

The existing cropping patterns are the cumulative effort of the generations of farmers who through trial and error have evolved a system based on the natural resource endowments such as altitude, rainfall, topography, soil etc. Thus, in the high ranges of Kerala, tea, coffee and cardamom are grown showing preference for cool humid climatic conditions and well drained soils. In the highland region, rubber, pepper, coconut etc. are found flourishing as high rainfall and extremely undulating topography provide moist but well drained soil conditions. In the midland, where the topography is mild, a variety of annual and seasonal crops are grown which are quick ripening and requiring frequent disturbance of top soil. Rice and coconut are the two main crops in the coastal low land. In general, valleys are put to crops that tolerate excessive moisture such as rice. The hill tops and slopes of steep gradients, especially the upper portions, are put to perennial crops such as rubber, coconut, cashewnut etc. which can stand the moisture stress of the summer months and do not require disturbance of the soil that accelerates soil erosion. The slope with mild gradients are put to seasonal and annual crops which entail disturbance of top soil but will not result in soil erosion. The lower portions of the steeper slopes are put to crops arecanut, pepper etc. demanding moist but well drained soils. Efforts have been made to identify the agronomic environments obtaining in the various areas by them. By juxtaposing the agronomic requirements of the crops over the agronomic conditions obtaining in the agro-climatic zones as identified by them the cropping patterns suited to each of the zones were drawn up. Appendix 14.8 (Statement II) contains recommended patterns for a few areas taken from their report.

14.6.117 Assam: Paddy is the dominant crop with seventy per cent or more area in general with some jute and plantations. The crop structure drawn up covers separately the three belts rice, jute and flood affected areas and for the three periods summer, kharif and rabi. While paddy will continue to be the main crop, emphasis will be on production of high yielding varieties (HYV) and increasing the area under rabi crops. They are also including fodder crops in the future crop patterns because of their importance in expanded animal husbandry programmes. Production of pulses will be encouraged. They are also taking up the question of perennial fodders such as grasses. Fodder should be grown as an intercrop in the Reserve Forest areas as well as on the hill slopes. Further experiments are proposed to evolve cropping patterns based on soil profile and irrigation facilities and also in the perennially flood affected areas such as Majuli, Sadia, Mankachar etc. Extension of irrigation facilities has become imperative in view of the expansion of rabi crop and changing pattern so as to advance the autumn paddy sowing date. The crop structure proposed by them is given in Appendix 14.8 (Statement III).

14.6.118 Maharashtra: The State is divided into sixteen rainfall zones. The major crops of the State are jowar (kharif and rabi), bajra and cotton. The State has examined the existing cropping structure in each rainfall zone and made some suggestions for modification. They have stressed the need for increased use of high yielding varieties, conservation of moisture by water harvesting techniques and increasing irrigation potential and diversion of submarginal and marginal lands for pasture and dairy development. Lower jowar kharif yields are attributed to cultivation on even . shallow black soils and partly due to less intensive cultivation methods. Cotton yields in the State are very low, less than 50 per cent of all-India. They have suggested the cultivation of hirsutum varieties and their extension in place of arborieum varieties which are taken at present even in deep soils. Cotton on marginal lands should be diverted to hybrid bajra and hybrid jowar. A few illustrative examples from their report are given in Appendix 14.8 .Statement IV.

14.6.119 Karnataka: The existing cropping patterns in different taluks have been critically examined in relation to the agronomic and economic feasibility for each crop. Suggestions for substituting the existing less efficient crops by more efficient ones are based on (a) quantity and distribution of rainfall (b) soil type altitude and topography (c) nature, extent and quantities of irrigation water available (d) existing cropping patterns (e) available research data (f) experience and observations of scientists and (g) existing agricultural development programmes. Karnataka State has 26 rainfall patterns and thus the State is divided into 26 rainfall zones. The State has for convenience grouped them according to (a) coastal belt (b) ghat region (c) transition belt and (d) dry belt. The cropping patterns under each rainfall pattern zone have been analysed and suggestions made. A feature of the report prepared by the State is detailed information on rainfall, existing crops, areas covered and crop yields. New crops to be tried, suggestions for change in practice and recommended cropping patterns are given for each of the taluks of the State. The report on cropping patterns for different rainfall zones and agro-climatic regions of Karnataka State made available to the Commission has been published in the University of Agricultural Sciences Technical Series No. 1 (1973) by the University of Agricultural Sciences, Bangalore. We are reproducing in Statement V, Appendix 14.7 four examples from the report to illustrate their approach; one of the taluk tables is also included.

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7. SUGGESTIONS FOR FUTURE CROPPING PATTERNS

14.7.1 Five steps are visualised in the formulation of future cropping patterns. These are:

i) Delineation of rainfall patterns.

ii) Identification of the existing cropping patterns.

iii) An idea of the area needed for each crop for national self-sufficiency and ideal location for its distribution.

iv) Juxtaposition of (iii) over (ii) and studying them together with (i) in order to determine possible changes.

v) Consideration of related factors like soil, irrigation, pressure of population, needs of livestock, proportion of forest vegetation, croped area, etc., and then arriving at the future cropping patterns on the basis of (iv).

The scope of the study commenced within the Commission envisages ultimately the inclusion of all the five steps. The Working Papers on States discussed with the State officials and experts already contain information on rainfall patterns, existing cropping patterns and related factors and, therefore, it was thought advantageous to set in motion the process of thinking at the State level independent of the efforts initiated within the Commission. A brief summary of the comments and suggestions made by five of the States has already been given in the preceding Section. We would urge the remaining States and Union Territories to prepare similar studies on rainfall and cropping patterns of their respective areas urgently on a priority basis. The future cropping patterns of each State/Union Territory should be discussed at various levels to enable improvements in the cropping patterns for increased production and productivity. The potential yields for various crops by 2000 AD have been indicated in Chapters 21, 22 on Foodgrains Crops, Commercial Crops etc. After each State has prepared and discussed its suggested patterns, these would have to be tested in the relevant areas and domonstration held to convince the farmers of advantages of the new suggestions.

Cropping Patterns under Different Rainfall Distributions

14.7.2 Reference will now be made to some of the main problems of Indian agriculture under different rainfall distributions in the country. A major feature of the country's agriculture is its large dependence on only two good rainy months of July and August during the southwest monsoon months of June to September which form the principal rainy season of the country. What is, however, needed is as stated earlier in Section 2, that rainfall of the same type is required for not less than three consecutive months for growing different types of crops satisfactorily. Table 14.22 gives the percentage areas under different rainfall types and categories. In this Table, district (and not taluk) rainfall patterns contained in Appendix 14.6 Statement VII have been employed. This was done as yield data are available for districts only. The areas shown in Table 14.22 would, therefore, not be the same as shown in tables of sections 4 and 5, the differences being generally small.

Table 14.22

Areas under Different Rainfall Types/Categories

Type/category	Per cent of all-India gross cropped area		Per cent irrigated area
A3/A4	6		12
A2 to B2	44	91	18
B1 or less	47		26
unaccounted due to lack of data etc.	3		
B3/B4	3	13	
C3/C4	9		
D3/D4	1		
A2, A1, B2, B1 C2, C1 D2, D1, E	78		

14.7.3 The areas under the same type of rainfall distribution for at least three months is less than 20 per cent. Thus, over about 80 per cent of the gross cropped area of the country, rainfall distributions only partially satisfy the criterion for growing different crops successfully. Irrigation support is also not adequate, being only 20 to 25 per cent. Under these conditions, it would be necessary to concentrate attention not only on the drought prone areas as usually understood and classified but also on the remainder of the area which is of the order of 50 per cent. Note in this connection should also be taken of the high variability of Indian rainfall even in the rainiest months of July and August (Chapter 13 on Climate and Agriculture). Besides riverine or water - logged conditions affect the crops in Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal, Orissa and Assam which have A2/B2 or A3/A4 rainfall types. It would therefore be almost futile to raise alarm against floods and droughts because these conditions are writ large over the country's weather patterns. Granting of loans or taking similar ameliorative measures could only be instant remedy but not a solution to these chronic problems. Crop insurance has also been suggested in this connection. A Committee set up by Government of India in 1970 held the view that this would not be feasible in the near future but suggested experimental trial schemes. The position has not materially changed since then. This subject has also been considered in Section 8 of Chapter 55 on Credit and Incentives. We therefore, feel that a permanent solution lies only in reorienting farming methods to the realities of the weather situations as prevail in the country. Combinations of A2 to B2 categories though partial, represent the next best categories after

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the ideal conditions of B3/B4 and C3/C4. These categories cover the following areas.

Distribution of Gross Cropped Areas of States in A2 to B2 categories of rainfall

Most area	Half area	Part area
Himachal Pradesh	Jammu & Kashmir	Punjab
Uttar Pradesh		Haryana
Madhya Pradesh		Rajasthan
Bihar		Gujarat
Orissa		Maharashtra
West Bengal		Andhra Pradesh
		Kerala

Of the above, the contiguous States of Uttar Pradesh, Madhya Pradesh, Bihar, Orissa, West Bengal together with the northern parts of Maharashtra account for about 45 per cent of the average gross cropped area of the country and about 60-65 per cent of the areas under wheat and rice. An idea of the performance of some important crops in these areas could be had from the following yield data.

Relative Yield Index (RYI=State value expressed as percentage of all-India) of selected Crops (1968-69 - 1970-71)

State	Rice	Maize	Jowar	Bajra	Pulses(b)	Cotton	Wheat	Gram
Uttar Pradesh	70	89	118	149	212	131	100	115
Madhya Pradesh	72	71	124	118	83	65	57	78
Bihar	71	90	90	111	158	214	73	99
Orissa	85	77	139	156	133	256	102	88
West Bengal	111	84	124	109	159	-	170	115
Maharashtra	99(a)	71	89	77	74	56	40	44

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a) includes Konkan area (A3-4)

b) other than tur and gram

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But for jowar, bajra and pulses, the yields of crops in their areas of importance are either subnormal or not commensurate with the soil and other available resources. This is an alarming situation particularly for rice, maize and cotton in so far as kharif season is concerned. It should be clear that Indian rainfall by itself is not sufficient to sustain a rice crop over vast areas of the country; it is suited most to crops like millets. If rice or other crops have to be grown with high standards of yield, the situation warrants careful examination for adoption of suitable means.

14.7.4 Some important combinations of rainfall between A2 and B2 types are given below together with remarks on their defects and suggestions for improvement.

(i)	A2 B2 -	This is the best condition next to A3-4 for rice cultivation. With suitable water conservation techniques, the position of water availability could be improved in B2 months which are invariably the months of June and September.
(ii)	A2 B1 C1 - A1 B2 C1 A2 C2	This condition is not congenial for rice except in low lying areas. A2 or A1 B1 (September not counted) conditions in July and August are good for crops like maize, soyabeen and urid, provided that there is no water-logging. For other crops, A2 or A1 conditions are harmful without proper drainage.
(iii)	B3 C1 - B2 C2	B3 or B2 C1 (June not counted) conditions in July - September period are good for most of Kharif crops provided that there is even distribution and no water-logging,

(iv) B2 C1 - Rainfalls insufficient during some periods requiring water conservation techniques. Moreover water-logging, when occurring due to concentrated spells, has to be countered with remedial measures.

Rice crop is prone to suffer in the rainfall categories A2 to B2 unless due provision is made in the rainy months to collect and store water for irrigation in the lean spells or months. For other crops, there is always a danger from water-logging, which condition can be avoided.. (a) by agronomic methods like laying rows of the crops across the slope, (b) taking the crop on ridges and (c) by draining excess water and collecting it in suitable situations.

14.7.5 The problems of areas with B1 or less rainfall are critical in the absence of supplementary sources of water supply. The distribution of areas is as follows:

Distribution of Gross Cropped Areas in B1
or less categories of Rainfall

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Most area	Half area	Part area
Punjab	Jammu & Kashmir	Himachal Pradesh
Haryana		Uttar Pradesh
Rajasthan		Madhya Pradesh
Gujarat		
Maharashtra		
Karnataka		
Andhra Pradesh		
Tamil Nadu		

The percentage of irrigated area corresponding to the gross cropped area of the concerned parts of these

States is: Jammu & Kashmir 60, Punjab 80, Haryana 43, Uttar Pradesh 64, Andhra Pradesh 31, Tamil Nadu 46, rest of the States below 15. The success of crops in many of these States is intimately related to irrigation. Moreover, the States in the north and south receive reainfall in one or more months of October to February also. As will be seen from discussions in the Chapters 21, 22 on Foodgrains Crops, Commercial Crops etc. the success in Gujarat is partly due to better farming methods too. Wherever all these conditions are not possible, the performance is low and those are the very areas which are designated as drought prone. The uplift in those areas also depends in principle upon the methods which have been suggested here in the foregoing paragraphs.

14.7.6 An important way of bringing success to crop cultivation in rainfed farming is through adjusting the time of sowing to such a date of commencement of rainfall which could ensure a reasonable supply of soil moisture to a given crop at least to begin with. To provide a second line of defence, one has also to keep ready a schedule of other crops which could be sown depending upon the early or late occurrence of rainfall so that the chance of complete failure inherent in placing reliance only on one date and one crop could be minimised. Some studies to determine probable dates of sowing based on meteorological conditions have already been initiated in the India Meteorological Department.[1]

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[1] Raman, C.R.V., 1974. Analysis of Commencement of Monsoon Rains Over Maharashtra State for Agricultural Planning, Poona, Meteorological Office, Meteorological Department.

These should be completed for the entire country in close liaison with the scientists of Agricultural Universities and other concerned institutions so that the results after trials could be adopted with advantage in a practical manner. The prognosis of an all-India character has primarily to ensure that the area and yield levels must meet the changing needs of the country. This can obviously be done at the national level only for the major crops, but in this process many other equally vital crops, which either occupy less area or are of local importance only, are left out. These crops are: some bast fibres, sugarcane, tobacco, potato, vegetables, various condiments and spices, fruits and plantation crops. Moreover, full justice cannot be done in a broad national prognosis to local, edaphic, ecological, economic and social factors. Therefore the cropping patterns to succeed must evolve from the lowest level. This is going to be a long drawn process, in which the present efforts represent only a beginning. Even when local experts have developed the patterns, these have to pass the test of time in actual practice and in that course might require modification again and again. Thus, the determination of future cropping patterns is going to be a continuous process for sometime to come and until a fair degree of stability has been achieved, it will be difficult to assign the same arithmetic accuracy to different crops in fixing their proportions as has been possible in the case of existing cropping patterns. What is outlined in the following paragraphs concerns the laying down of certain principles around which a continuous thinking can go on for modifications.

General Observations on Future Cropping Patterns

14.7.7 Rainfall distribution with regard to monthly amounts and spread have been analysed and presented in this chapter. Some of the inferences that can be drawn are discussed in the context of present cropping patterns and future possible changes that can be brought about in cropping patterns. We have attempted to give the guidelines in Karnataka Report and also for each crop in the Crop Chapters Hence, it is intended to indicate here general principles on which changes could be attempted.

14.7.8 It has been pointed out at a number of places in this Chapter that for raising a certain crop, certain types of distribution of rainfall are required for a specified period. It has been indicated that for paddy, rainfall of more than 30 cm pm is required for at least three consecutiv months and for maize it is atleast 20 cm per month and for bajra 10 cm pm. Such ideal conditions prevail only in small areas in the country. In most parts of the country, however, the rainfall distributions present combination of two to three classes of rainfall amounts. For instance, there is a vast area with A2 B2 pattern, viz., 30 cm or more in two months and 20 to 30 cm pm in the remaining two months. In some areas, it is only one month with A type, another month B type and third month with C type and so on. In about 25 per cent of the area, precarious conditions prevail; rainfall being 10 to 20 cm pm in not more than two months in a year and those are not even consecutive months in some areas. The rainfall amounts indicated here are no doubt on an average but the extent of variability of monthly and seasonal rainfall is discussed in Chapter 13 on Climate and Agriculture. Variability is large from year to year which implies that in some years rainfall is more than normal, while in some others it would be lower. It has been usually observed in a three year period that one year is normal, one above and the third below normal. The situation in the low rainfall areas is very much more precarious because of higher variability. Only two out of five years have normal or above normal conditions thus reducing the chances of even fairly good yield to two out of five years. The position worsens further in slopy lands and lighter soils. Where the soils are heavy and retentive and where the lands are level, the position improves. Taking all these factors into consideration, steps required to be taken to increase and stabilise agricultural production in these areas should be worked out. One of the ways, no doubt, is to provide irrigation facilities. We would like to state here that highest priority should be given to these regions in providing facilities for bringing as much area as possible under irrigation through all means. The first step should be to provide flow irrigation through large medium and minor irrigation works. Second step would be to explore the possibilities of tapping underground water resources wherever available. Detailed survey should be undertaken to locate underground water resources. Care, however, has to be taken to see that the resources are not over-exploited but that all necessary steps are taken for recharging arrangements. In addition, arrangements should be made to hold as much water as possible in farm ponds and in valleys by taking appropriate measures for gully plugging wherever possible. Adoption of all kinds of water harvesting techniques within each holding as well as outside on community basis will also help in stabilising production. Continuous improvements will have to be brought about in farming systems applicable to various local situations.

14.7.9 In spite of all the measures suggested above, there will be need for changing the cropping patterns themselves. Because of pressure of population, land has been opened and used irrationally. Land use planning has to be done and implemented on scientific basis. In any scheme of land use planning, consideration will have to be given to the existing as well as future needs and the system of farming suitable for the land. At present, there is too much emphasis on arable crops irrespective of the suitability of land or sufficiency of rainfall. With the hope that the year would be normal or above normal, crops have been chosen and grown all these years.

14.7.10 All arable crops need rainfall on time but rainfall in these regions is most uncertain. It may be early or late. Crop failures are more often due to unseasonal rainfall rather than due to shortage in total amounts. Even in years of low total rainfall, the yields have been observed to be quite high if the rainfall is timely and well distributed. In one of the studies, it has been shown that well distributed rainfall of just 15 cm during the life span of bajra gave highest yield as against the years where the rainfall was much more but ill distributed. Well distributed rainfall may be expected only two or three times in a decade. It is, therefore, necessary to restrict growing of arable crops only to most favourable areas which have good retentive soils and are situated in valleys so that the rainfall that occurs could be well-preserved in soil profiles and it would also be possible to adopt water harvesting techniques. The remaining areas should be put under forage and economic tree crops either as sole crops or in mixture. It is only by bringing about such changes in cropping patterns that stability can be brought to agricultural production under rainfed conditions in these low rainfall areas. It would also be possible to convince the farmers to switch over to such crops only if it can be demonstrated that it is economical to do so and arrange not only for supply of inputs and services etc. needed but also arrange for the use of output locally or for marketing wherever needed. Allthis is possible only if research efforts are intensified in this direction and suitable recommendations developed as applicable to different regions.

14.7.11 The remaining 75 per cent of the area in the country receives rainfall of ~~more than~~ 10 to 20 cm pm or more for three months or longer in a year. It should, therefore, be possible in such areas to get at least one good crop in a year. What is needed, therefore, is to decide on crops which fit best in different regions of the country taking into account the soil, rainfall and other factors into consideration. Every crop has a certain water use rhythm and every region has certain water supply rhythm. A crop can be said to be adapted to a region only when these two rhythms concur. The result would show up better according to the closeness of the rhythms. Attempt has, therefore, to be made to introduce such crops and varieties that fit best in the environmental rhythm of a place. No doubt, the existing cropping patterns have evolved through ages and they represent the local environmental situations and needs. Cropping patterns have to be flexible and should be adjusted to meet the changing needs taking into consideration the advances in tedhnology.

14.7.12 The studies carried out in the Commission with regard to rainfall and cropping patterns along with the existing productivity levels have clearly brought out that there is considerable scope for improving the cropping structure in different regions. It is clear that the synchronisation of the rainfall rhythm and crop rhythm does not appear to have been taking place in many cases.

Hence, while discussing the cropping patterns in different Regions in Section 6, possible changes have been indicated.

14.7.13 One of the crops that is widespread and grown under varying conditions is paddy. As has been stated earlier, it requires rainfall of 30 cm pm for at least three consecutive months, but paddy is being grown even in areas where the rainfall is just 30 cm pm only in one month and without irrigation support. In such areas, it has been shown that yields are very low and uncertain. Just changing over from paddy to crops like maize would mean increased production by as much as two to three tonnes of grains per hectare. Paddy yields in these regions are as low as half a tonne per hectare. Maize yields under same situations can be as much as 4 tonnes per hectare. In addition, year to year variations in production will also be less.

14.7.14 There are a number of such examples in the country. It has been stated in earlier Sections that the cropping patterns adopted in Gujarat can be a good example to prove how good yields can be obtained by adjusting crops taking the minimum in the pattern into account but not the maximum. For instance, if the pattern includes A, B as well as C classes of rainfall amounts in each of the three months, then it is better to take the crops that require C or B amounts at the most into consideration rather than A while choosing the crops. The only problem, when choice is done in this manner, is the possibility of excess water conditions developing and hampering crop growth during the month of A type rainfall can, however, be got over to a very great extent by providing for drainage right from the beginning, anticipating such a situation. This is probably done in many areas of Gujarat. Even if A type occurs in one or two months in some regions which provides a temptation for taking paddy, Gujarat farmers have not gone for paddy but appear to have been content with cotton, jowar or maize or such similar crops. The yields are above the national average in case of many crops in Gujarat which can be seen from Appendix 14.6 (Statement II). As against such a good performance in Gujarat, the yields of paddy and many other crops are low in many of the eastern as well as central States like Bihar, Uttar Pradesh, Orissa, Madhya Pradesh and Maharashtra. Paddy is being grown in these States even when rainfall is not sufficient for it and without irrigation support. Cotton yields in Maharashtra are much low as compared to Gujarat although rainfall patterns are not much different.

14.7.15 In Andhra Pradesh, Tamil Nadu and Karnataka, the position seems different. All irrigation resources are used for growing paddy instead of using these for growing other crops also under irrigation, taking full advantage of irrigation to supplement rain water resources rather than supplanting it. There might be strong and valid reasons for doing so; but it is necessary to examine as to whether water resources can be put to better use than what is being done now both from socio-economic point of view as well as from human nutrition and other agronomic points of view. It may be advantageous to divert some water at least for growing crops like groundnut, pulses and even jowar and maize for animal consumption and also fodder legumes with a view to build up and mantaining soil fertility. There is a case for restricting paddy to one season only in the southern States when rainfall amounts are in higher ranges in one or two months at least and utilising irrigation water for growing various crops other than paddy,keeping the points mentioned above in view. It is necessary to give a serious trial to this suggestion. As stated earlier, farmers will, no doubt, switch over only when it is demonstrated that it is economical to do so and the infrastructure is built to enable a smooth switch over. Research attempts are also wanting with these objectives in view and they should be intensified.

14.7.16 There is another example from Karnataka where in recent years maize is being taken in Tibetan colonies established to resettle Tibetan population that migrated to India from Tibet, instead of paddy which is commonly grown in surrounding areas. These colonies are in Mysore and Dharwar districts of Karnataka in the transitional belt where rainfall is not sufficient for paddy, but paddy is still the main crop in the region. The yield levels of maize on an average over a thousand hectares or more have been of the order of 3 to 4 tonnes per hectare as against not even one tonne of paddy in surrounding areas. There are vast areas in the country where paddy yields are low and the economy of the regions could be improved by changing over to maize, soyabean and cotton and thus release the paddy growing population from the shackles of poverty. Such potentialities are tremendous and as stated earlier, more research and extension efforts are needed with these objectives.

14.7.17 It is always argued that it is difficult to change cropping patterns because farmers are accustomed to growing the crops that they are growing for ages and it is difficult to change the food and other habits. It is also argued that the existing cropping patterns are proven ones and have stood the test of time. In this regard again, many examples can be quoted where changes have occurred and farmers have taken to new crops. In the beginning of the century, groundnut was not an important crop of the country, but now, India is one of the three leading groundnut growing countries of the world. Even during 1930s, groundnut was not an important crop in many areas. Farmers of Bardoloi tehsil in Surat district of Gujarat took to vegetable growing during war period on a large scale because it was economical. Then they changed over to banana. After 1955, they took to sugarcane cultivation and a sugar factory is running successfully now. A factory was recommended and established when sugarcane was not a major crop in that area. Farmers learnt the art of growing sugarcane in a short period and they have been successful sugarcane growers. Similarly, increase of area under maize especially in the southern parts of Karnataka where maize was unknown is another example how farmers do take to new crops provided the necessary arrangements are made to educate them and for marketing the produce. The way Varalakshmi cotton hybrid spread to non-cotton areas when fantastic yields were reported and prices rule very high is a good example too. There are examples when a kilogram of cotton seed was sold at Rs 500 or more. Growing of wheat by farmers of West Bengal in recent years is yet another example. Yields of wheat in Bengal and maize in Karnataka are on the high side. New crops of sunflower and soybean are getting popular in certain areas. Many other examples could be cited but the examples given here should be more than sufficient to show that cropping patterns can be changed provided advantages of doing so are clearly demonstrated. This implies greater research in the first instance and intensified extension efforts in later stages. Infrastructure needed is required to be built side by side. Apart from the suitability of the crop from the points of view of soils and climate the net return from the crop is also an important consideration which weighs with the farmer in the choice of a crop. This factor has also to be taken into account before the recommendations are made by the extension agencies.

14.7.18 We would like to remove any impression, if created, that the limits of rainfall used in the study are sacrosanct and that it is only the rainfall that determines the yield levels. These levels are based on general experience and from available data. Lower amounts than those indicated here may be sufficient for getting good yields when the lands are level and soils have better water-holding capacity. When soils are of sandy type and lands are slopy, the rainfall amounts indicated as sufficient may not yield expected results. Better distribution would be naturally considered desirable under such situations rather than just total amounts. In addition, temperature and other climatic factors would also influence the production to a certain extent. In spite of all these limiting factors which vary from field to field and area to area, the study has brought out that rainfall distribution patterns with a knowledge of monthly variability could be used as an important basis in any scheme for changing cropping patterns.

14.7.19 We have come to the conclusion that the rain water resources are good over vast parts of the country and productivity of every bit of land in the country could be raised considerably bringing about improvement in the cropping patterns in different regions in the country taking into account the rainfall patterns in general and taking lower limits of rainfall amounts in the patterns in particular. By adopting similar principles, productivity can be increased even in the remaining 25 per cent of the area where the rainfall is really very low to precarious, as discussed earlier. Keeping in view the findings of the analysis indicated here, recommendations have been made with regard to adjustment of various crops in the various crop chapters in the volume on Crop Production, Sericulture and Agriculture. It can, therefore, be said that it is the way the rainfall resources are used which contribute to low or high production rather than the rainfall itself. It is not intended to minimise the depressing influences that droughts and floods have on production, but the situation can be improved by containing them in all possible ways.

14.7.20 The changes will have to be brought about in the next 25 years as indicated in the crop chapters. The required steps will have to be initiated immediately on priority basis for determining and adopting more suitable cropping patterns than the existing ones. The first step is to take up detailed studies on the lines indicated here and formulate proposals for launching research and extension programmes to achieve the main objective of putting every hectare of land in the country to its best use. The material as available in each of the State reports published separately will provide the basic information for carrying out the analysis and studies suggested here. The data published will have to be brought up-to-date and studied continuously.

14.7.21 To sum up, it can be said that Indian rainfall is variable from place to place, month to month and year to year. It is restricted to a few days in a year in some areas as in Rajasthan and is spread over a long period of 7 to 9 months in some areas like Assam and Kerala. This is a natural phenomenon and it is not possible to modify the same. When this is a known fact, it is essential to adjust the cropping plan to get the maximum yield per hectare on a sustained basis. The task is exacting and challenging and, therefore, calls for matching action.

14.7.22 A Report on Karnataka Rainfall and Cropping Patterns prepared on the above lines is given in Appendix 14.9.

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8. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

14.8.1 The main conclusions and recommendations are summarised in this Section. Our observations and suggestions regarding cropping patterns in Rainfall Regions are as under:-

i) Region 1: This is the area of lowest rainfall distribution in the country. Arable crops will have to be restricted to low lying areas with good retentive soils. It is advisable to divert the areas from arable to forage and economic tree crops either as sole crops or in mixture. More research and extension efforts will have to be put in with this objective.

(Paragraph 14.6.9)

ii) Region 2: Reasons for low yields of bajra and rabi jowar in Maharashtra and cotton in Andhra Pradesh and Karnataka should be examined and necessary measures taken urgently to increase the yields of these crops or for substituting them with more suitable crops.

(Paragraph 14.6.14)

iii) Region 3: Excepting Gujarat, the yield levels of crops without irrigation are on the low side some of them being less than 50 per cent of all-India average as in the case of bajra. The position has to be remedied by adopting better varieties or agronomic practices or by substitution of more suitable crops.

(Paragraph 14.6.19)

iv) Region 4: Although the crops grown appear to be suitable according to rainfall distribution, the yields are low in the case of almost all crops grown in the portion of the Region covering areas in Maharashtra, Madhya Pradesh and Rajasthan. There is, thus great need for detailed analysis, research and developmental efforts. Similar efforts are needed in the case of gram and other crops which have low yields in Andhra Pradesh and Karnataka.

(Paragraph 14.6.29)

v) Region 5: There is need for adopting better water management and agronomic practices for improving the yields of maize and bajra in Rajasthan area; groundnut in Surendranagar district (Gujarat) may be substituted by sunflower after carrying out trials.

(Paragraph 14.6.22)

vi) Region 6: Though the crops grown are nearly suited to rainfall distribution, yield levels in Rajasthan area are low. These could be improved by adopting better agronomic practices and improved varieties or hybrids.

(Paragraph 14.6.25)

vii) Region 7:

(a) In spite of fairly good irrigation support wheat yields in Rajasthan and Uttar Pradesh areas of the Region, are low. The reason as to why these should not be at almost, the same level as in the Punjab needs to be looked into. Similar remarks apply to maize in Rajasthan and paddy in Uttar Pradesh.

(b) In case it is not possible to provide irrigation support to wheat and if it is difficult to increase yields under rainfed conditions, it may be considered as to why this area should not be diverted to barley, gram, safflower or other such crops.

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(c) Paddy yields cannot be high without irrigation support and it may be advisable therefore to divert paddy area to maize or other suitable crops after providing for proper drainage facilities.

(Paragraph 14.6.34)

viii) Region 8: Growing of paddy and wheat does not appear to be advisable in areas where yields are low for lack of irrigation support. In areas where irrigation development is not possible should be diverted to other appropriate crops after study.

(Paragraph 14.6.38)

ix) Region 9: Paddy crop dominates but rainfall is insufficient and required irrigation facilities are not available; yields of other crops are also low. Careful examination is necessary.

(Paragraph 14.6.41)

x) Region 10: The Region is entirely in Gujarat and with the rainfall distribution with A type in July there could be a temptation to go in for paddy. However, crops other than paddy are being taken with good yields. This could be cited as a good example of an area where cropping patterns have stabilised after taking the minimum likely rainfall into account. In areas with above average rainfall, drainage aspect is fully taken care of. This example of Gujarat is worth emulation by others.

(Paragraph 14.6.43)

xi) Region: 11 Yield levels of many of the crops are low except in Gujarat areas, though rainfall distribution is good for majority of the crops. Paddy yields cannot be high unless crop is irrigated. The cropping structure of the Region should be examined in detail with a view to bringing about improvement in both structure and productivity.

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(Paragraph 14.6.47)

xii) Region 12:

(a) Rainfall distribution seems more suited for millets, maize and cotton but not for paddy without supplemental irrigation.

(b) Reasons for low yields of crops in some States of the Region and good yields in others like Gujarat, need to be looked into.

(c) Cultural and other practices in States where the yields are good should be studied and extended to other areas in the Region, in addition to carrying out the needed research.

(Paragraph 14.6.50)

xiii) **Regions 13 and 14:** Yield levels of paddy and wheat, the two major crops of the Regions are on the low side. Rainfall in September is not sufficient to support paddy crop and irrigation facilities are wanting both for paddy and wheat. The crop distribution needs detailed examination for evolving and adopting appropriate measures.

(Paragraph 14.6.57)

xiv) Regions 15 and 16: Paddy is the main crop of these Regions but yields are low, the chief reason being insufficiency of rainfall in September. These Regions are more suitable for paddy than other crops and hence necessary steps should be taken for providing irrigation facilities. In case this cannot be done, paddy areas may be diverted to other crops.

(Paragraph 14.6.60)

xv) Region 17:

(a) Rainfall resources are more than adequate for growing paddy in valleys and hill millets in elevated areas. Paddy yield in Bulsar district (Gujarat) could be raised. There is good scope for increasing the yields of ragi by adopting better varieties and agronomic practices.

(b) There is scope for introducing improved varieties of grass and forage legumes. Soyabean in rotation with ragi could be tried. Maize also could be tried.

(c) Region is good for production forestry and economic tree crops.

(Paragraph 14.6.63)

xvi) Regions 18 to 22: Paddy yields are high in general. Millet yields are very good in Tamil Nadu and moderate in Andhra Pradesh. Pulse yields are low. The reasons for the same are required to be looked into and improvements brought about.

(Paragraph 14.6.68)

xvii) Regions 23 to 26: Paddy can be grown only with irrigation and this is what is being done. Conditions are nearly favourable for maize in regions 25 and 26. Introduction of this crop along with soyabean is worth examining. Measures required to be taken to further increase the yield levels of the existing crops also need examination.

(Paragraph 14.6.72)

xviii) Regions 27 to 29: There are possibilities of diverting areas under crops like paddy with a view to introducing protein yielding crops and fodder crops which may be examined along with the possibilities of increasing yield levels of existing crops.

(Paragraph 14.6.75)

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xix) Regions 30 to 36: Paddy dominates whether rainfall is sufficient or not. The only good feature is that it is grown mostly under irrigation and yields are high. It may, however, be necessary to consider as to whether available water could be better utilised for raising other crops on larger areas with advantage. This suggestion especially applies to regions 30 and 31, where the rainfall is good for raising crops like jowar, ragi, etc. Maize can be a good crop for these regions and may be tried. Similarly soyabean and cotton can be good crops in Regions 31 to 36. Plantation crops should also be considered especially in regions 33 to 36. Since there is rainfall in October month in addition to monsoon months, possibilities of raising pulses and fodder crops in paddy fallows with supplementary irrigation is worth considering.

(Paragraph 14.6.79)

xx) Regions 37, 41, 42, 44, 45, 47, 48 and 55: Paddy is the major crop of these Regions. Regions 41, 42, 44, 47 and 48 do not have favourable rainfall distribution for paddy. Regions 41 and 48 do not have even one month of A type rainfall. Region 42 has only one and 44 two months of A type. Moisture stress in September and floods affect the yields. There is scope for substitution of paddy with maize and similar crops in Regions 41, 44, 47 and 48. Soyabean too can be a good crop for these Regions.

(Paragraph 14.6.83)

xxi) Regions 38 to 40: These are scanty rainfall Regions with long intervening breaks. It is therefore necessary to examine possibilities of putting larger areas under grasses and economic tree crops which can stand prolonged drought better than arable crops.

(Paragraph 14.6.90)

xxii) Regions 43, 46 and 50 to 53: Cropping structure in general appears to be appropriate. With long rainy seasons and with milder temperature, it would be advisable to pay more attention to fruit crops and grassland development in high lying areas.

(Paragraph 14.6.93)

xxiii) Region 54: More attention to grassland and fruit crops may be desirable.

(Paragraph 14.6.95)

xxiv) Regions 56-62: Cropping structure appears to be satisfactory. In Regions 56-57 paddy could be replaced in high lying areas with maize and soyabean with advantage. Possibilities of taking short duration pulses, oilseeds, fodder crops and vegetables appear to be feasible before and after paddy. The high lying areas where raising of plantation crops is difficult, could be used for developing grasslands. These regions are good for production forestry and plantation crops. Tendency of opening up slopy lands for arable crops has to be discouraged.

(Paragraph 14.6.87)

14.8.2 General observations and suggestions regarding cropping patterns etc. are as under:-

i) Rice crop is prone to suffer in areas under rainfall categories A2 to B2 unless due provision is made in the rainy months to collect and store water for irrigation in the lean periods. For other crops there is always danger from water logging to avoid which suitable agronomic measures should be adopted right from the beginning

(Paragraph 14.7.4)

ii) Studies on optimum dates of sowing should be completed for the whole country in close liaison with the scientists of agricultural universities, institutions and departments for adoption of the results after large scale trials in the field.

(Paragraph 14.7.6)

iii) In about 25 per cent area precarious conditions prevail, rainfall being 10 to 20 cm pm in not more than two months in the year which are not ever consecutive months in some areas. Variability of rainfall in these areas is also high. High priority should be given to these regions in providing irrigation for as much as possible area. All kinds of water harvesting techniques within each holding as well as outside on community basis are necessary for stabilising production.

(Paragraph 14.7.7)

iv) There is too much emphasis on arable crops irrespective of the suitability of land or sufficiency of rainfall. Land use planning has to be done on a scientific basis and implemented.

(Paragraph 14.7.9)

v) Field crops should be restricted to most favourable areas which have good retentive soils and are situated in valleys so that the rainfall could be preserved in soil profiles and water harvesting techniques adopted. The remaining areas should be put under forage and economic tree crops either as sole crops or in mixture. Research efforts in these directions should be intensified and suitable recommendations developed as applicable to different regions.

(Paragraph 14.7.10)

vi) Attempt should be made to introduce crops and varieties which fit best in the environmental rhythm of a place. Cropping patterns should be flexible for adjustment to changing needs taking into consideration advances in technology.

(Paragraphs 14.7.11,
14.7.3 &
14.7.21)

vii) If rainfall pattern of a Region includes A, B and C classes of rainfall amounts in each of the three consecutive months, it is better to go in for crops that require C or B amounts of rainfall and not A. In such cases, steps should be taken right from the beginning for drainage of excess water.

(Paragraph 14.7.14)

viii) All irrigation resources in Andhra Pradesh, Tamil Nadu and Karnataka are used mainly for growing paddy. It is necessary to examine as to whether water resources could be put to better use from socio-economic as well as from human nutrition and other agronomic points of view.

(Paragraph 14.7.15)

ix) There is a case for restricting paddy to one season only in the southern States with rainfall amounts in higher ranges in one or two months and utilising irrigation water for growing other crops. Farmers will switch over only when it is economical to do so. Research attempts should be intensified keeping these various objectives in view.

(Paragraphs 14.7.15 &
14.7.17)

x) Rainfall distribution patterns with a knowledge of monthly variability could be used as an important basis in any scheme for changing cropping patterns.

(Paragraph 14.7.18)

xi) Urgent steps would have to be initiated on priority basis for determining and adopting more suitable cropping patterns than the existing ones. Detailed studies should be taken up on the lines indicated and keeping in view the proposed targets and suggestions made in the crop chapters, formulate research and extension programmes to achieve the main objective of putting every hectare of land to its best use.

(Paragraph 14.7.20)

Appendix 14.1

(Paragraph 14.2.4)

Code form for Combinations of Rainfall of Four Months in Different Intervals

Code form	Number of months	Rainfall (cmpm)
1. Beginning with	(greater than 30 cm)	
A4	4	greater than 30
A3 B1	3	greater than 30
	1	20-30
A3 C1	3	greater than 30
	1	10-20
A3 E1	3	greater than 30
	1	less than 10
A2 B2	2	greater than 30
	2	20-30
A2 B1 C1	2	greater than 30
	1	20-30
	1	10-20
A2 B1 E1	2	greater than 30
	1	20-30
	1	less than 10
A2 C2	2	greater than 30
	2	10-20
A2 C1 E1	2	greater than 30
	1	10-20
	1	less than 10
A2 E2	2	greater than 30
	2	less than 10
A1 B3	1	greater than 30
	3	20-30

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Appendix 14.1 contd.

Code form	Number of months	Rainfall (cmpm)
A1 B2 C1	1	greater than 30
	2	20-30
	1	10-20
A1 B2 E1	1	greater than 30
	2	20-30
	1	less than 10
A1 B1 C2	1	greater than 30
	1	20-30
	2	10-20
A1 B1 C1 E1	1	greater than 30
	1	20-30
	1	10-20
	1	less than 10
A1 B1 E2	1	greater than 30
	1	20-30
	2	less than 10
A1 C3	1	greater than 30
	3	10-20
A1 C2 E1	1	greater than 30
	2	10-20
	1	less than 10
A1 C1 E2	1	greater than 30
	1	10-20
	2	less than 10
A1 E3	1	greater than 30
	3	less than 10

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Appendix 14.1 contd.

Code form	Number of months	Rainfall (cmpm)
2. Beginning with B (20 - 30 cm)		
B4	4	20-30
B3 C1	3	20-30
	1	10-20
B3 E1	3	20-30
	1	less than 10
B2 C2	2	20-30
	2	10-20
B2 C1 E1	2	20-30
	1	10-20
	1	less than 10
B2 E2	2	20-30
	2	less than 10
B1 C3	1	20-30
	3	10-20
B1 C2 E1	1	20-30
	2	10-20
	1	less than 10
B1 C1 E2	1	20-30
	1	10-20
	2	less than 10
B1 E3	1	20-30
	3	less than 10

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Appendix 14.1 contd.

Code form	Number of months	Rainfall (cmpm)
3.Beginning with C (10 - 20 cm)		
C4	4	10-20
C3 D1	3	10-20
	1	5-10
C3 E1	3	10-20
	1	less than 5
C2 D2	2	10-20
	2	5-10
C2 D1 E1	2	10-20
	1	5-10
	1	less than 5
C2 E2	2	10-20
	2	less than 5
C1 D3	1	10-20
	3	5-10
C1 D2 E1	1	10-20
	2	5-10
	1	less than 5
C1 D1 E2	1	10-20
	1	5-10
	2	less than 5
C1 E3	1	10-20
	3	less than 5

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Appendix 14.1 contd.

Code form	Number of months	Rainfall (cmpm)
4. Beginning with D (5 -10 cm)		
D4	4	5-10
D3 E1	3	5-10
	1	less than 5
D2 E2	2	5-10
	2	less than 5
D1 E3	1	5-10
	3	less than 5
5. Beginning with E (less than 5 cm)		
E4	4	less than 5

Note: Rainfall Interval Code

letter symbol	amount cm
A	greater than 30
B	20-30
C	10-20
D	5-10
E	less than 5

(i) Less than 10 cm when code form for four months begins with A c

(ii) Less than 5 cm when code form for four months begins with C D or E

cmpm - Centimetres per month

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Example: A2 B1 E1

2 months	greater than 30 cmpm
1 month	20 - 30 cm
1 month	less than 10 cm

Appendix 14.2

(Paragraph 14.3.2)

Statement I - Frequency of Districts in different Area Intervals

State	Geographical area sq km	Total no. of districts	Number of districts with area (thousand sq km) Less than 5	5-10	10-20	greater than 20
1	2	3	4	5	6	7
Andhra Pradesh	276,754	21	—	6	15	—
Assam*	99,610	10	1	5	3	1
Bihar	173,876	17	1	8	8	—
Gujarat	195,984	19	2	10	6	1
Haryana	44,222	7	3	3	1	—
Himachal Pradesh	55,673	10	4	5	1	—
Jammu & Kashmir	222,236@	10	6	2	1	1
Karnataka	191,773	19	3	7	9	
Kerala	38,864	10	8	2	—	
Madhya Pradesh	442,841	43	4	22	15	2
Maharashtra	307,762	26	1	8	16	1
Manipur	22,356	5	4	1	—	—
Meghalaya	22,489	2		1	1	—
Nagaland	16,527	3	1	2	—	—
Orissa	155,842	13		4	8	1
Punjab	50,362	11	7	3	1	—
Rajasthan	342,214	26	1	10	10	5
Tamil Nadu	130,069	14	3	4	7	
Tripura	10,477	3	3	—	—	—
Uttar Pradesh	294,413	54	29	23	2	—
West Bengal	87,853	16	8	6	2	—
total		339	39	132	106	12
Union Territories		17				
total no. of districts.		356				

* Includes Mizoram district.

@ Includes area under illegal occupation of Pakistan and China.

Appendix 14.2 (Paragraph 14.3.4)

Statement II - Frequency of Districts with Density of Population in different Intervals

State	geographical area (sq km)	Population 1971 (million)	Density per sq km	Density intervals: less than or equal to 100	101-150	151-200	201-300	301-500	501-750	751-1000	greater than 1000	Total no. of districts
	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
				number of districts								
1. Andhra Pradesh	276,754	43.5	157	2	8	4	5	2				21
2. Assam *	99,610	15.0	150	3		2	4	1				10
3. Bihar	173,876	56.4	324		2	2	1	8	4			17
4. Gujarat	195,984	26.7	136	4	4	3	5	3				19
5. Haryana	44,222	10.0	227			1	6					7
6. Himachal Pradesh	55,673	3.5	62	6	1	3						10
7. Jammu & Kashmir	222,236 @	4.6	21	4	3	1	2					10
8. Karnataka	191,773	29.3	153	2	7	7	2	1				19
9. Kerala	38,864	21.3	549				-	3	5		2	10
10. Madhya Pradesh	442,841	41.7	84	15	21	6	1					43
11. Maharashtra	307,762	50.4	164	1	13	8	3				1	26
12. Manipur	22,356	1.1	48	4	1							5
13. Meghalaya	22,489	1.0	45	2								2
14. Nagaland	16,527	0.5	31	3								3
15. Orissa	155,842	21.9	141	3	6	1	2	1				13
16. Punjab	50,362	13.6	269			2	5	4				11
17. Rajasthan	342,214	25.8	75	14	8	4						26
18. Tamil Nadu	130,069	41.2	317			2	4	6	1		1	14
19. Tripura	10,477	1.6	149		2		1					3
20. Uttar Pradesh	294,413	88.3	300	4	6	4	3	31	6			54
21. West Bengal	87,853	44.3	504				4	5	4	1	2	16
Total				66	82	50	43	65	20	1	6	339

contd.)

Union Territory	Area (sq km)	Population (million)	Density per sq km
Andaman and Nocobar Islands	8,293	0.1	14
Arunachal Pradesh	83,578	0.5	6
Chandigarh	114	0.3	2256
Dadra and Nagar Haveli	491	0.07	151
Delhi	1,485	4.1	2723
Goa, Daman & Diu	3,813	0.9	225
Laccadive, Minicoy and Amindivi Islands	32	0.03	994
Pondicherry	480	0.5	983

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* Includes Mizoram district

@ Includes area under illegal occupation of Pakistan and China.

APPENDIX 14.2

(Paragraph 14.3.5)

Statement III – Work Force (Human and Animal) in Agriculture

State/Union Territory	Total population 1971 (thousand)	Work force in agriculture (between 15-59 years) (thousand)	Percent of col.(3) to col.(2)	Total livestock 1972 (thousand)	Draught animals in agriculture (thousand)	Percent of col.(6) to col.(5)
1	2	3	4	5	6	7
Andhra Pradesh	43,503	10,821	24.9	33,064	6,785	20.5
Assam*	14,958	2,794	18.7	8,210	2,305	28.1
Bihar	56,353	12,220	21.7	27,946	7,821	28.0
Gujarat	26,697	4,802	18.0	15,098	3,070	20.3
Haryana	10,037	1,457	14.5	6,200	990	16.0
Himachal Pradesh	3,460	807	23.3	4,703	762	16.2
Jammu & Kashmir	4,617	829	18.0	4,285	726	16.9
Karnataka	29,299	5,931	20.2	22,424	3,885	17.3
Kerala	21,347	3,087	14.5	4,936	603	12.2
Madhya Pradesh	41,654	10,375	24.9	39,989	9,487	23.7
Maharashtra	50,412	10,369	20.6	26,361	6,345	24.1
Manipur	1,073	223	20.8	507	114	22.5
Meghalaya	1,012	310	30.6	760	110	14.5
Nagaland	516	167	32.4	335	10	3.0

APPENDIX 14.2 (contd)

Statement III (contd)

State/Union Territory	Total population 1971 (thousand)	Work force in agriculture (between 15-59 years) (thousand)	Percent of col.(3) to col.(2)	Total livestock 1972 (thousand)	Draught animals in agriculture (thousand)	Percent of col. (6) to col.(5)
1	2	3	4	5	6	7
Orissa	21,945	4,566	20.8	17,569	5,121	29.1
Punjab	13,551	1,974	14.6	9,295	1,752	18.8
Rajasthan	25,766	5,183	20.1	38,878	3,996	10.3
Tamil Nadu	41,199	8,197	19.9	23,979	4,765	19.9
Tripura	1,556	279	17.9	738	194	26.3
Uttar Pradesh	88,341	17,810	20.2	49,099	15,233	31.0
West Bengal	44,312	6,560	14.8	19,646	4,886	24.9

APPNEDIX 14.2 (contd)

Statement III (contd)

State/Union Territory	Total population 1971 (thousand)	Work force in agri-culture (between 15-59 years) (thousand)	Percent of col.(3) to col. (2)	Total livestock 1972 (thousand)	Draught animals in agriculture (thousand)	Percent of col.(6) to col.(5)
1	2	3	4	5	6	7
Andaman and Nicobar Islands	115	15	13.0	77	9	11.7
Arunachal Pradesh	468	188	40.2	n.a.	n.a.	n.a.
Chandigarh	257	4	1.6	19	2	10.5
Dadra and Nagar Haveli	74	27	36.5	55	19	34.5
Delhi	4,066	49	1.2	238	21	8.8
Goa, Daman and Diu	858	105	12.2	237	68	28.7
Lakshadweep	32	2	6.3	5	n.a.	n.a.
Pondicherry	472	61	12.9	153	27	17.6

* including Mizoram district

n.a. not available

APPENDIX 14.2

(Paragraph 14.3.7)

Statement IV - Land Utilisation Statistics 1969-70

(thousand hectar

State/Union Territory	Geographical area	Reporting area for land utilisation	Forests †	Not available for cultivation			Other uncultivated land excluding fallow land	
				area put to non-agricultural uses †	barren and unculturable land †	total †	permanent pastures and other grazing lands †	land under miscellaneous tree, crops and groves not included in net area sown †
1	2	3	4	5	6	7	8	9
Andhra Pradesh	27,676	27,440	6,369 (23.2)	2,032 (7.6)	2,053 (7.5)	4,135 (15.1)	1,152 (4.2)	323 (1.2)
Assam (b)	7,353	7,807	2,080 (26.6)	768 (9.8)	1,802 (23.1)	2,570 (32.9)	234 (3.0)	227 (2.9)
Bihar	17,383	17,330	3,017 (17.4)	1,517 (8.8)	1,072 (6.2)	2,589 (15.0)	175 (1.0)	186 (1.1)
Gujarat	19,593	18,562	1,634 (8.8)	627 (3.4)	4,200 (22.6)	4,827 (26.0)	1,019 (5.5)	20 (0.1)
Haryana	4,422	4,402	97 (2.2)	269 (6.1)	219 (5.0)	488 (11.1)	57 (1.3)	4 (0.1)
Himachal Pradesh	5,567	5,082	2,783 (54.8)	131 (3.6)	117 (2.3)	293 (5.9)	1,188 (23.4)	41 (0.8)
Jammu and Kashmir	22,224	4,523(c)	2,778 (61.4)	268 (5.9)	276 (6.1)	544 (12.0)	134 (3.0)	107 (2.4)
Kerala	3,886	3,859	1,056 (27.4)	268 (6.9)	74 (1.9)	342 (8.8)	28 (0.8)	140 (3.6)

APPENDIX 14.2, Statement IV (contd.)

	Other uncultivated land excluding fallow land		Fallow land			Net area sown +	Area sown more than once ++	Net irrigated area ++	Gross irrigated area @@
+	culturable waste land +	total +	Fallow land other than current fallows +	current fallows +	total +				
	10	11	12	13	14	15	16	17	18
Andhra Pradesh	1,222 (4.5)	2,697 (9.9)	910 (3.3)	1,819 (6.6)	2,729 (9.9)	11,510 (41.9)	1,635 (14.2)	3,189 (27.7)	4,153 (31.6)
Assam (b)	184 (2.4)	645 (8.3)	173 (2.2)	113 (1.5)	286 (3.7)	2,226 (28.5)	547 (24.6)	572 (25.7)	572 @ (20.6)
Bihar	534 (3.1)	895 (5.2)	907 (5.2)	1,527 (8.8)	2,434 (14.0)	8,395 (48.4)	2,668 (31.7)	2,279 (27.1)	2,741 (24.8)
Gujarat	552 (3.0)	1,591 (8.6)	392 (2,1)	690 (3.7)	1,082 (5.8)	9,428 (50.8)	617 (6.5)	1,209 (12.8)	1,307 (13.0)
Haryana	48 (1.1)	109 (2.5)	- -	160 (3.6)	160 (3.6)	3,548 (80.6)	1,393 (39.2)	1,408 (39.7)	2,158 (43.7)
Himachal Pradesh	161 (3.2)	1,390 (27.4)	2 (0.0)	60 (1.2)	62 (1.2)	544 (10.7)	367 (67.4)	91 (16.7)	156 (17.1)
Jammu and Kashmir	155 (3.4)	396 (8.8)	15 (0.3)	86 (1.9)	101 (2.2)	704 (15.6)	164 (23.2)	279(i) (39.6)	338 (38.9)
Kerala	81 (2.1)	249 (6.5)	23 (0.6)	23 (0.6)	46 (1.2)	2,166 (56.1)	750 (34.6)	423 (19.5)	589 (20.2)

Appendix 14.2, Statement IV (contd.)

1	2	3	4	5	6	7	8	9
Madhya Pradesh	44,284	44,237	14,437 (32.6)	2,064 (4.7)	2,362 (5.3)	4,426 (10.0)	3,110 (7.0)	209 (0.5)
Maharashtra	30,776	30,768	5,409 (17.6)	682 (2.2)	1,774 (5.8)	2,456 (8.0)	1,351 (4.4)	195 (0.6)
Manipur (d)	2,236	2,211	602 (27.2)	26 (1.2)	1,380 (62.4)	1,406 (63.6)	(i)	24 (1.1)
Meghalaya (e)	2,248	2,248	180* (8.0)	- -	1,905 (84.7)	1,905 (84.7)	- -	- -
Karnataka	19,177	18,938	2,868 (15.1)	923 (4.9)	852 (4.5)	1,775 (9.4)	1,633 (8.6)	308 (1.6)
Nagaland (f)	1,653	1,351	266 (19.7)	- -	985* (72.9)	985* (72.9)	- -	- -
Orissa	15,584	15,540	4,960 (31.9)	1,000* (6.4)	802* (5.2)	1,802 (11.6)	723 (4.7)	431 (2.8)
Punjab	5,036	5,030	119 (2.4)	415 (8.2)	220 (4.4)	635 (12.6)	5 (0.1)	5 (0.1)
Rajasthan	34,222	34,107	1,342 (4.0)	1,173 (3.4)	4,709 (13.8)	5,832 (17.2)	1,835 (5.4)	11 (0.0)
Tamil Nadu	13,007	13,004	2,016 (15.4)	1,473 (11.3)	854 (6.6)	2,327 (17.9)	223 (1.7)	232 (1.8)

Appendix 14.2, Statement IV (contd.)

	10	11	12	13	14	15	16	17	18
Madhya Pradesh	2,239 (5.1)	5,558 (12.6)	848 (1.9)	635 (1.6)	1,533 (3.5)	18,283 (41.3)	2,015 (11.0)	1,431 (7.8)	1,471 (7.2)
Maharashtra	708 (2.3)	2,254 (7.3)	1,105 (2.6)	1,082 (3.5)	2,187 (7.1)	18,462 (60.0)	973 (4.7)	1,431 (7.8)	1,623 (3.4)
Manipur (d)	(i) -	24 (1.1)	- -	(a) -	(a) -	179 (3.1)	9 (5.0)	65 (36.3)	75 (39.9)
Meghalaya (e)	- -	- -	- -	- -	- -	163 (7.2)	22 (19.6)	37@ (22.7)	37@ (19.0)
Karnataka	631 (3.4)	2,572 (13.6)	621 (3.3)	905 (4.8)	1,526 (8.1)	10,197 (53.8)	507 (5.9)	1,144 (11.2)	1,305 (12.1)
Nagaland (f)	- -	- -	- -	- -	- -	100* (7.4)	2 (2.0)	12 (2.0)	12 (11.8)
Orissa	807 (5.2)	1,961 (12.7)	97 (0.6)	626 (4.0)	723 (4.6)	6,094 (39.2)	2,388 (37.5)	1,027 (16.9)	1,423 (17.0)
Punjab	89 (1.8)	99 (2.0)	- -	150 (3.0)	150 (3.0)	4,027 (80.0)	1,472 (36.5)	2,826 (70.4)	4,080 (74.2)
Rajasthan	6,378 (18.7)	8,224 (24.1)	3,008 (8.8)	2,556 (7.5)	5,564 (16.3)	13,095 (38.4)	1,172 (8.9)	2,059 (15.7)	2,419 (17.0)
Tamil Nadu	527 (4.1)	982 (7.6)	600 (4.6)	1,010 (7.8)	1,610 (12.4)	6,069 (46.7)	1,092 (17.9)	2,507 (41.3)	3,272 (45.7)

Appendix 14.2, Statement IV (contd.)

1	2	3	4	5	6	7	8	9
Tripura	1,048	1,048	630 (60.1)	44 (4.2)	6 (0.6)	50 (4.8)	34 (3.2)	86 (8.2)
Uttar Pradesh	29,441	29,960(o)	4,969 (16.6)	2,022 (6.8)	1,438 (4.8)	2,460 (11.6)	78 (0.3)	1,273 (4.3)
West Bengal (g)	8,785	8,852(o)	1,101 (12.4)	(h) -	1,272 (14.4)	1,272 (14.4)	(i) -	607 (6.9)
Union Territories								
Andaman & Nicobar Islands	829	790	740 (93.7)	2 (0.3)	1 (0.1)	3 (0.4)	3 (0.4)	19 (2.4)
Arunachal Pradesh(k)	8,358	6,352	5,154 (81.1)	- -	1,143 (18.0)	1,143 (18.0)	- -	- -
Dadra & Nagar Haveli	49	49	21 (42.9)	(a) -	3 (6.1)	3 (6.1)	8 (16.3)	- -
Delhi	149	148	2 (1.4)	31 (20.9)	15 (10.1)	46 (31.0)	1 (0.7)	(a) -
Goa, Daman & Diu	381	370	105 (28.4)	21 (5.7)	16 (4.3)	37 (10.0)	1 (0.3)	1 (0.3)
Lakshadweep	3	3	- -	(a) -	- -	(a) -	- -	(a) -
Mizoram (l)	2,109	2,002	1,298 (62.0)	- -	755 (36.1)	755 (36.1)	- -	- -

Appendix 14.2, Statement IV (contd)

	10	11	12	13	14	15	16	17	18
Tripura	3 (0.3)	123 (11.7)	2 (0.2)	3 (0.3)	5 (0.5)	240 (22.9)	103 (42.9)	21 (8.8)	21 (6.1)
Uttar Pradesh	1,373 (4.6)	2,724 (9.2)	558 (1.9)	792 (2.6)	1,350 (4.5)	17,357 (58.1)	5,611 (32.3)	6,814 (39.3)	7,929 (34.5)
West Bengal	(i) -	607 (6.9)	330 (3.7)	(j) -	330 (3.7)	5,542 (62.6)	1,512 (27.2)	1,489 (26.9)	1,541 (21.8)
Union Territories									
Andaman & Nicobar Islands	5 (0.6)	27 (3.4)	1 (0.1)	1 (0.1)	2 (0.2)	18 (2.3)	(a) -	- -	- -
Arunachal Pradesh (k)	- -	- -	- -	- -	- -	55(m) (0.9)	n.a. -	- -	- -
Dadra & Nagar Haveli	- -	8 (16.3)	1 (2.0)	-- -	1 (2.0)	16 (32.7)	1 (6.2)	(a) -	(a) -
Delhi	4 (2.7)	5 (3.4)	7 (4.7)	8 (5.4)	15 (10.1)	80 (54.1)	31 (38.7)	47 (58.8)	57 (51.4)
Goa, Daman & Diu	93 (25.1)	95 (25.7)	- -	- -	- -	133 (35.9)	6 (4.5)	8 (6.0)	8 (5.8)
Lakshadweep	- -	(a) -	- -	(a) -	(a) -	3 (100.0)	(a) -	(a) -	(a) -
Mizoram (l)	- -	- -	- -	- -	- -	39 (1.9)	1 (2.6)	2(@) (5.1)	2(@) (5.0)

Appendix 14.2, Statement IV (contd.)

1	2	3	4	5	6	7	8	9
Pondicherry	48	47	- -	11 (23.4)	(a) -	11 (23.4)	1 (2.1)	2 (4.3)
All-India	328,048 (n)	306,050	66,038	15,867	30,305	46,172	12,993	4,451

Appendix 14.2 (contd.)

	10	11	12	13	14	15	16	17	18
Pondicherry	1 (2.1)	4 (8.5)	(a) -	1 (2.1)	1 (2.1)	31 (66.0)	20 (64.5)	26 (83.9)	39 (76.5)
All-India	15,795	33,239	9,600	12,297	21,937	133,704	25,078	30,406	37,328

Source: Directorate of Economics and Statistics, Ministry of Agriculture and Irrigation, Government of India.

Notes:
(a) Below 500 hectares.
(b) Data relate to the year 1968-69 except in case of net area sown and areas sown more than once.
(c) Excludes information of area under the unlawful occupation of China and Pakistan.
(d) *Ad-hoc* estimates
(e) Data relate to Garo Hills and U.K. & J hills distts. of Assam State for the year 1968-69 except otherwise stated.
(f) Data relate to Naga hills district of Assam State for the year 1956-57.
(g) Data relate to the year 1967-68.
(h) Included under the head "Barren and unculturable land"
(i) Included under the head "Land under miscellaneous tree crops and groves etc.
(j) Included under the head "Fallow land other than current fallows".
(k) Data relate to the year 1956-57.
(l) Data relate to Mizo hills distt of Assam State for the year 1968-69 except otherwise stated.
(m) Relates to rice crop only.
(n) Includes area of 11 squarekilometers in respect of Chandigarh for which other data are not available.
(o) The figures of reporting area in case of Uttar Pradesh and West Bengal are under verification.
* Adjusted

@ Relate to the year 1953-54.
n.a. Data not available.
† Figures in parantheses represent percentage to reporting area in Col.3.
†† " " " " " " net area sown in Col.15
@@ " " " " " " gross cropped area

APPENDIX 14.2

(Paragraph 14.3.8)

Statement V-Frequency Distribution of Districts according to Percentages of Net Irrigated Area to Net Sown Area

State	Net irrigated area as per cent of area sown						Total number of districts	Reference of year
	less than 10	10-20	20-30	30-40	40-50	greater than 50		
1	2	3	4	5	6	7	8	9
Andhra Pradesh	2	7	3	2	3	4	21	1970-71
Bihar	7	3	4	-	-	3	17	1970-71
Gujarat	6	10	2	-	-	-	18	1969-70
Haryana	-	1	1	1	3	1	7	1970-71
Himachal Pradesh	5	2	2	-	-	1	10	1969-70
Jammu and Kashmir	2	2	1	-	1	3	9	1967-68
Karnataka	6	8	2	2	1	-	19	1970-71
Madhya Pradesh	31	6	4	2	-	-	43	1970-71
Maharashtra	19	5	1	-	-	-	25	1969-70
Orissa	5	5		2	1	-	13	1969-70
Punjab	-	-	2		1	8	11	1969-70
Rajasthan	9	5	6	1	3	-	24	1970-71
Tamil Nadu		1	1	6	1	3	12	1970-71
Uttar Pradesh	3	6	10	13	10	12	54	1969-70
West Bengal	3	-	6	2	1	3	15	1964-65

Appendix 14.2, Statement V (contd.)

1	2	3	4	5	6	7	8	9
Tripura	1	-	-	-	-	-	1	1970-71
Union Territories								
Goa, Daman and Diu	1	-	-	-	-	-	1	1970-71
Pondicherry		-	-	-	-	1	1	1970-71
Delhi		-	-	-	-	1	1	1970-71
total	100	61	45	31	25	40	302	

Note: In the case of the following States irrigation data for some/all districts are not available or their irrigated areas are less than 500 ha:-

Jammu and Kashmir	Rajouri district formed in 1967-68 only.
Gujarat	Dangs district irrigated area less than 500 ha
Maharashtra	Greater Bombay irrigated area less than 500 ha
Rajasthan	Churu , Jaisalmer districts irrigated area less than 500 ha
Tamil Nadu	Madras city and Nilgiris districts irrigated areas less than 500 ha.

Assam Kerala Manipur Meghalaya Nagaland	Irrigation data not available for all districts

Appendix 14.2

Statement VI - Irrigated Area according to Sources (Paragraph 14.3.9)

State/Union Territory	Irrigated area (thousand ha)	Percent of total Irrigated Area (col 2)					
		Canals			tanks	wells	others
		Govt.	private	total			
1	2	3	4	5	6	7	8
		percentages					
1. Andhra Pradesh	3313	47.7	-	47.7	33.6	15.3	3.4
2. Assam (a)	572	12.4	50.9	63.3	-	-	36.7
3. Bihar	2160	37.6	0.1	37.7	7.8	25.5	29.0
4. Gujarat (b)	1209	16.9	0.2	17.1	2.5	79.6	0.8
5. Haryana	1532	62.1	-	62.1	0.1	37.5	0.3
6. Himachal Pradesh (b)	91	-	-	-	-	1.1	98.9
7. Jammu & Kashmir (c)	279	22.2	75.3	97.5	-	0.3	2.2
8. Karnataka	1137	36.9	0.1	37.0	32.1	22.8	8.1
9. Kerala	431	46.6	2.3	48.9	16.9	1.2	33.0
10. Madhya Pradesh	1480	47.9	0.1	48.0	8.8	38.0	5.2
11. Maharashtra	1427	19.6	2.2	21.8	15.8	57.6	4.8
12. Manipur (d)	65	-	-	-	-	-	100.0
13. Meghalaya (a)	37	-	-	-	-	-	100.0
14. Nagaland (e)	12	-	-	-	-	-	100.0
15. Orissa (f)	1149	20.1	2.8	22.9	50.7	3.9	22.5
16. Punjab	2888	44.5	0.2	44.7	-	55.1	0.2
17. Rajasthan	2132	35.5	-	35.5	12.7	50.8	1.0
18. Tamil Nadu	2592	34.1	-	34.1	34.6	29.9	1.4
19. Tripura	22	-	-	-	-	-	100.0
20. Uttar Pradesh	7190	34.7	-	34.7	5.2	56.1	4.0
21. West Bengal (c)	1489	42.2	22.3	64.5	20.3	1.1	14.1
22. Union Territories	85	28.2	1.2	29.4	8.2	51.3	10.6
All-India	31292	37.1	2.9	40.0	14.5	37.3	7.7

Note :- The data are for 1970-71 except for the following :

(a) Relates to the year 1953-54
(b) Relates to the year 1969-70
(c) Relates to the year 1967-68
(d) Ad-hoc estimates
(e) Relates to the year 1956-57
(f) Source-wise break-up estimated.

APPENDIX 14.3

(Paragraph 14.3.11)

Statement I - Livestock Categories as per cent of total Livestock Population - Statewise (1972, 1966)

(Percent

Sl. No.	State		Cattle			Buffaloes			sheep	Goats	Horses & ponies	Pigs	Cam-els	Other Live-stock	Total live-stock (thou-sands)
			males over 3 years	females over 3 years	young-stock	males over 3 years	fema-les over 3 years	young stock							
1	2		3	4	5	6	7	8	9	10	11	12	13	14	15
1.	Andhra Pradesh	1972	16.6	12.8	8.4	4.1	10.6	6.7	25.2	13.2	0.1	2.1	-	0.2	33,064
		1966	17.1	13.2	8.8	4.6	10.2	6.7	25.3	11.9	0.2	1.9	-	0.2	31,595
2.	Assam	1972	26.3	24.1	19.3	2.9	2.9	2.0	0.3	17.8	0.2	4.0	-	0.2	8,210
		1966	28.0	21.9	22.3	2.7	2.1	1.6	0.6	17.3	0.4	3.1	-	-	8,457
3.	Bihar	1972	26.1	15.0	12.3	2.6	6.8	3.8	3.5	26.4	0.4	3.1	-	0.1	27,946
		1966	24.2	14.3	14.4	2.6	5.8	4.4	4.4	27.2	0.4	2.3	-	0.1	28,655
4.	Gujarat	1972	20.3	12.0	10.5	0.3	13.6	9.1	11.4	21.3	0.4	0.1	0.4	0.7	15,098
		1966	21.6	12.4	11.6	0.2	12.7	9.0	11.5	19.3	0.5	0.0	0.3	0.8	14,388
5.	Haryana	1972	15.1	11.5	12.4	1.0	20.4	18.7	7.3	7.6	0.4	2.3	2.1	1.3	6,200
		1966	16.6	11.1	12.6	0.6	18.3	16.1	9.4	9.4	0.4	1.8	2.4	1.4	5,528
6.	Himachal Pradesh	1972	19.2	14.3	12.8	0.3	7.7	3.6	22.1	19.3	0.3	0.1	-	0.4	4,703
		1966	16.2	14.6	14.2	0.4	6.5	3.1	25.0	19.4	0.3	0.1	0.0	0.3	4,201
7.	Jammu and Kashmir	1972	16.1	17.9	14.1	1.2	6.7	3.7	25.0	13.3	1.4	0.0	0.1	0.7	4,285
		1966	13.7	16.0	14.2	1.0	6.1	3.4	28.2	14.9	1.6	-	0.1	0.8	4,079
8.	Karnataka	1972	17.3	16.9	11.0	1.4	8.3	5.1	21.5	16.9	0.2	1.3	-	0.3	22,424
		1966	17.9	17.4	11.9	1.4	8.3	4.6	23.2	13.6	0.3	1.0	-	0.2	20,486
9.	Kerala	1972	7.9	26.3	23.6	4.6	3.2	1.8	0.2	29.7	-	2.6	-	-	4,936
		1966	11.2	26.3	24.1	5.5	2.9	1.8	0.3	25.6	2.4	-	-	-	4,641
10.	Madhya Pradesh	1972	24.0	20.3	21.8	2.9	6.4	5.3	2.5	15.4	0.4	0.9	-	0.1	39,989
		1966	23.9	19.1	21.0	3.2	6.1	5.3	2.6	17.2	0.4	1.0	0.1	0.2	38,478

Appendix 14.3, (Statement I (contd) (Percentages)

Sl. No.	State		Cattle			Buffaloes			Sheep	Goats	Horses & ponies	Pigs	Camels	Other Live-stock	Total live-stock (thousands)
			males over 3 years	famels over 3 years	young-stock	males over 3 years	females over 3 years	young stock							
1	2		3	4	5	6	7	8	9	10	11	12	13	14	15
11.	Maharashtra	1972	23.5	17.4	14.8	1.2	7.1	4.3	8.1	22.4	0.2	0.8	-	0.2	26,361
		1966	23.7	17.8	14.3	1.3	6.8	3.8	8.7	20.1	0.4	0.7	0.0	0.3	25,449
12.	Manipur	1972	24.7	18.7	14.6	3.2	4.1	3.0	0.4	3.2	0.2	26.4	-	1.6	507
		1966	25.9	19.0	19.1	4.3	3.6	2.9	2.0	2.7	0.2	16.7	-	2.7	444
13.	Meghalaya	1972	19.9	22.8	19.0	1.3	2.6	2.1	2.4	12.6	0.7	16.7	-	-	760
		1966	19.7	22.6	17.8	2.0	1.9	1.6	3.0	14.5	1.3	15.6	-	-	691
14.	Nagaland	1972	6.9	11.6	9.3	1.2	1.2	0.6	-	5.4	0.3	54.9	-	8.7	335
		1966	9.3	13.0	13.0	0.9	0.5	0.5	-	6.0	0.5	51.6	-	4.7	215
15.	Orissa	1972	25.5	23.0	15.9	3.6	2.5	1.9	7.8	16.4	0.2	2.2	-	-	17,569
		1966	26.8	20.8	17.1	3.6	2.4	1.7	7.2	18.8	0.4	1.1	-	0.1	16,422
16.	Punjab	1972	16.2	10.5	12.1	2.9	22.5	18.3	4.7	9.6	0.6	0.4	1.3	0.9	9,295
		1966	17.2	11.1	13.9	3.4	20.2	16.3	5.9	8.3	0.5	0.6	1.6	0.9	7,481
17.	Rajasthan	1972	10.1	11.9	10.1	0.4	6.4	5.0	22.0	31.3	0.1	0.3	1.9	0.5	38,878
		1966	10.9	12.8	11.3	0.4	5.7	5.1	23.5	27.5	0.2	0.2	1.7	0.5	37,475
18.	Tamil-Nadu	1972	19.8	15.6	9.5	1.7	6.3	4.0	23.4	16.8	0.1	2.4	-	0.4	23,979
		1966	20.1	15.1	9.0	2.0	5.5	3.6	26.9	15.3	0.1	1.9	-	0.4	24,569
19.	Tripura	1972	27.2	23.2	20.7	1.1	1.1	0.5	0.3	19.9	-	6.0	-	-	733
		1966	26.0	22.3	24.2	2.2	2.5	1.5	0.2	16.3	0.2	4.6	-	-	811
20.	Uttar Pradesh	1972	27.9	13.7	11.6	3.3	13.5	8.8	4.0	13.4	0.5	2.7	0.1	0.5	49,099
		1966	26.5	13.5	12.3	12.9	12.0	8.0	5.2	16.3	0.5	2.3	0.1	0.5	49,972
21.	West Bengal	1972	24.5	19.7	17.9	2.7	1.1	0.5	4.1	27.4	0.1	1.9	-	0.1	19,646
		1966	25.5	21.7	18.1	2.8	1.5	1.1	3.3	25.1	0.1	0.7	-	-	19,266

Appendix 14.3 contd

Appendix 14.3, Statement I (contd)

(Percentages)

Sl. No.	Union Territory		Cattle			Buffaloes									
			males over 3 years	females over 3 years	young stock	males over 3 years	females over 3 years	young stock	sheep	Goats	Horses & ponies	Pigs	Camels	Other Live-stock	Total live-stock (thousand
1	2		3	4	5	6	7	8	9	10	11	12	13	14	15
1.	Andaman & Nicobar Islands	1972	9.1	7.8	7.8	3.9	3.9	2.6	-	14.3	-	50.7	-	-	77
		1966	6.0	6.0	8.0	8.0	4.0	4.0	-	20.0	-	44.0	-	-	50
2.	Arunachal Pradesh	1972			........NA.............										
		1966			........NA.............										
3.	Chandigarh	1972	10.5	10.5	5.3	-	42.1	15.8	5.3	10.5	-	-	-	-	19
		1966	9.4	6.2	9.4	-	31.2	18.7	6.3	12.5	-	6.3	-	-	32
4.	Delhi	1972	3.4	10.1	10.1	0.4	31.9	21.4	1.7	5.0	3.4	4.6	0.4	2.5	238
		1966	12.9	11.5	10.6	0.5	29.5	18.0	2.3	6.5	2.3	2.8	0.9	2.3	217
5.	Goa, Daman and Diu	1972	24.9	14.8	12.7	4.6	7.2	4.2	0.8	8.9	-	21.9	-	-	237
		1966	23.1	15.3	13.2	4.6	6.2	3.7	0.4	8.7	-	24.8	-	-	242
6.	Dadra & Nagar Haveli	1972	30.9	23.6	18.2	3.6	1.8	-	-	21.8	-	-	-	-	55
		1966	27.3	21.8	20.0	3.6	1.8	1.8	-	23.6	-	-	-	-	55
7.	Lakshadweep	1972	-	20.0	-	-	-	-	-	80.0	-	-	-	-	5
		1966	-	14.3	-	-	-	-	-	85.7	-	-	-	-	7

Appendix 14.3

Statement II - Livestock patterns in each State

Paragraph 14.3.12

	Cm	Cf	Cy	S	G	Bf
Tamil Nadu						
1.	Cm3 S4 Cf4	Cf3 S4 G4		S2 Cm4 (G4)	G3 Cm4 Cf4 Cy4	
2.	Cm3 Cf4 Cy4 G4	Cf4 Cm4 Cy4 G4		S3 Cf4 G4	G4 Cm4 Cf4 Cy4/S4	
3.	Cm4 S4 Cf4 G4/Cy4			S3 Cm4 G4/Cf4		
4.	Cm4 S4 Cf4 G4 Cy4/Bf4			S3 G4 Cm4 Cf4		
5.	Cm4 Cf4 G4 Cy4			S4 Cm4 G4 Cf4		
6.				S4 Cm4 Cf4 G4 Cy4		
Kerala						
1.		Cf3 Cy3			G3 Cf4 Cy4	
2.		Cf4 Cy4 G4			G4 Cf4 Cy4 Bm4/Cm4	
Karnataka						
1.	Cm3 Cf4 Cy4	Cf3 S4 Cy4/G4/Cm4	Cy3 Cf4 Cm4 S4	S3 Cm4 Cf4 G4/Cy4/Bf4	G4 S4 Cm4	Bf4 Cm4 By4 Cf4
2.	Cm4 Cf4 S4 G4	Cf3 Cy4 Cm4/Bm4		S3 C4 Cm4/Bf4 /Cf4	G4 S4 Cm4 Cf4/Cy4-Bf4	
3.	Cm4 Cf4 Cy4-G4/S4/Bf4	Cf4 Cm4 Cy4 S4/G4		S4 Cm4 Cf4-G4/Bf4/Cy4		
4.	Cm4 Cf4 Cy4/P4	Cf4 Cy4 Cm4/Cm4 Bf4				
5.		Cf4 Cy4 Cm4/Cm4 Bm4		S4 G4 Cm4 Cf4/Bf4		

Appendix 14.3 contd.

	Cm	Cf	S	G	Bf
	ANDHRA PRADESH				
1.	Cm3 Cf4 Cy4/G4	Cf3 Cm3 Cy4	S3 G4 Bf4 By4/ Cm4	G3 Cm4 Cf4- Cy4	Bf3 By4 G4 Cm4
2.	Cm4 Cf4 S4 G4/ Cy4/Bf4 Bm4	Cf4 Cm4 G4 Bf4	S3 G4 Bf4/ Cm4/Cf4		Bf4 S4 Cm4 Cf4
3.	Cm4 Cf4 Cy4 S4	Cf4 Cm4 Cy4 S4/ G4	S3 G4 Cf4 Cm4 Bf4		Bf4 By4 Cm4 Cf4/ S4/Bm4
4.	Cm4 Cf4 Cy4 Bf4- G4/By4/S4		S3 Cm4 Cf4/G4 Bf4		Bf4 By4 Cm4 Cf4 S4
5.			S3 G4 Cf4 Cm4/Cy4		Bf4 Cm4 Cf4 Cy4 By4/S4
6.			S3 Cm4 Cf4 G4/Cy4		Bf4 Cm4 Cf4 By4 S4/ Cy4/G4
7.			S4 Cf4 G4 Bf4 Bm4		
8.			S4 G4 Cm4 Cy4 Bf4		
9.			S4 Cm4 Cf4 Cy4 / G4		
10.			S4 G4 Cm4 Cf4 Bf4/By4/Bm4/Cy4		Bm4
11.			S4 G4 Bf4 By4		
12.			S4 Bf4 By4 Cm4 G4		

Appendix 14.3 contd.

	Cm	Cf	S	G	Bf
	Gujarat				
1.	Cm3 G4 Cf4/Bf4		S3 Cm4 Bf4	G3 Cf4 Cy4/Cm4	Bf3 By4 Cm4
2.	Cm4 Cf4 Cy4/G4		S3 G4 Cm4/Cf4	G4 S4 Cf4	Bf4 Cm4 By4/G4
3.	Cm4 G4 Cf4/Cy4		S4 G4 Cy4/Cf4	G4 Cm4 Cf4 Cy4/S4/Bf4	Bf4 By4 Cm4 G4
4.	Cm4 Cf4 Cy4 G4/S4/Bf4		S4 Cm4 Cf4 G4/Cy4	G4 Bf4 Cm4 Cy4/S4	
5.	Cm4 Bf4 By1 G4		S4 G4 Cm4 Cf4	G4 Bf4 Cm4	
6.	Cm4 Bf4 S4 Cy4/Cf4		S3 Cm4 G4 (Spl.)	G3 Cm4 Bf4 (Spl.)	
7.	Cm4 G4 Cy4 Cf4/Bf4				
8.	Cm4 Bf4 Cf4 Cy4				
Rajasthan					
1.	Cm4 G4 Bf4 By4 Cf4	Cf4 Cm4 Cy4 Bf4	S2 Cf4	G3 S3	
2.			S3 G4 Cf4/Cy4/Cm4	G3 S4 Cf4/Cy4	
3.			S4 G4 Cf4 Cy4 Bf4/Cm4	G3 Cm4 S4/Cf4/Cy4	
4.			S4 G4 Cf4 Cm4/Cy4	G3 Cf4 Cy4	
5.			S4G4Cm4 Cf4/Cy4	G3 S4 Cy4 Cm4	
6.				G3 S4 Cm4 Cf4/Cy4	
7.				G3 S4 Cf4 Cy4/By4/Bf4	
8.				G3 S4 Cm4 Cy4/By4	
9.				G4 S4 Bf4 Cy4 Cf4/By4	
10.				G4 S4 Cm4 Cf4 Bf4/Cy4	
11.				G4 Cm4 Cf4 Cy4	
12.				G4 Cm4 Cf4 Cy4 Bf4	
13.				G4 By4 Cf4 Cy4 S4/Cm4	

Appendix 14.3 contd.

	Cm	Cf	Cy	S	G	Bf
	Haryana					
1.	Cm4 Cy4 Bf4 Cf4/By4				G4 S4 Cy4 Cf4	Bf4 By4 S4 Cy4 Cm4/G4
2.					G4 S4 Cy4 By4 Cf4/Bf4	Bf4 G4 Cm4 By4 Cy4
3.					G4 Bf4 By4 Cm4	Bf4 By4 Cm4 Cy4/G4
	Punjab					
1.	Cm4 Bf4 By4 Cy4		Cy4 Cf4 Cm4 S4/Bf4		G4 S4 By4 Bf4 Cm4	Bf4 By4 Cm4 Cy4/G4/Cf4
2.						Bf4 Cm4 Cf4 Cy4 S4/By4
3.						Bf4 G4 Cm4
	Jammu and Kashmir					
1.			Cy4 Cf4 Bf4 Cm4	S3 G4	G3 S4	Bf4 S4 G4 Cm4/Cm4 Cy4
2.				S3 Cf4 Cm4/ Cy4	G4 Cf4 Cm4 Cy4/Bf4	
3.				S4 G4 Cf4 Cy4	G4 S4 Cf4 Cy4 Cm4	
	Himachal Pradesh					
1.	Cm4 Cf4 Cy4/G4 G4 S4/Bf4	Cf3 Cm4 Cy4/- /S4/G4	Cy4 Cf4 Cm4 G4/ /S4	S1	G3 S4 Cy4/D4	Bf4 Cm4 S4 G4
2.		Cf4 Cm4 Cy4- S4/Bf4/G4		S2 G4/Cf4	G3 Cy4 Cf4/Cm4	
3.				S3 G3	G3 Cm4 Bf4/Cf4/Cy4	
4.				S3 G4 Cm4/- Cf4/Cy4	G4 S4 Cm4 Cf4/- /Cy4/Bf4	
5				S4 G4 Cm4 Cf4/ /Cy4		

Appendix 14.3 contd.

Cm	S	G	Bf
Uttar Pradesh			
1. Cm3 Cf4 Cy4 G4	S4 G4 Cm4 Cf4/Cy4	G4 Cm4 Cf4 Cy4	Bf4 By4 Cm4
2. Cm3 Cf4 Cy4		G4 Cm4 Cf4 Cy4 Bf4	Bf4 By4 Cm4 G4/Cy4 G4/ Cf4 S4
3. Cm3 Bf4 By4 Cf4/Cy4		G4 Cm4 Bf4 By4/ /By4 Cy4	
4. Cm4 Cf4 Cy4 G4			
5. Cm4 Cf4 Cy4 Bf4			
6. Cm4 Bf4 By4			
7. Cm4 Cf4 Cy4 G4 Bf4			

Appendix 14.3 contd.

Cm	Cf	Cy	G
Bihar			
1. Cm4 G4 Cf4 Cy4/Bf4			G3 Cm4 Cf4/Cy4/S4
2.			G4 Cm4 Cf4 Cy4
West Bengal			
1. Cm3 G4 Cf4/Cy4	Cf 3 Bf4 G4/Cy4		G3 Cm4 Cf4/Cy4
2.	Cf4 G4 Cm4/Cy4		G4 Cm4 Cf4/Cy4
Orissa			
1. Cm3 Cf4 Cy4/G4	Cf3 Cm4 Cy4	Cy3 Cm4 G4	G3 Cm4 Cf4/Cy4
2. Cm4 Cf4 Cy4/G4/Cy4 Bf4	Cf4 Cm4 Cy4/G4	Cy4 Cm4 Cf4	G4 Cm4 Cf4/Cf4 Cy4
3. Cm4 G4 Cf4 Cy4/ S4/Bm4	Cf4 Cm4 Cy4 S4/G4		
Madhya Pradesh			
1. Cm3 Cf4 Cy4		Cy4 Cm4 Cf4	G4 Cm4 Cf4 Cy4
2. Cm4 Cf4 Cy4/G4			
3. Cm4 Cf4 Cy4 G4/Bf4			
4. Cm4 G4 Bf4 By4 Cf4/Cy4/S4			

Appendix 14.3 (contd.)
Statement II (contd.)

Maharashtra

Cm	Cf	Cy	S	G
1. Cm3 Cf4 Cy4/G4	1Cf4 Cm4 Cy4 G4/S4	-	1. S2 G4	1 G3 Cm4 Cf4/Cfy/S4
2. Cm4 Cf4 Cy4/G4			2. S3 Bf4 Cm4	2 G4 Cm4 Cf4/Cy4
3. Cm4 Cf4 Cy4 G4/Bf4/S4			3. S3 G4 Cm4/Cy4	3.G4 Cm4 Cf4 Cy4/Bf4/S4
4. Cm4 Cf4 Bf4 Cy4/G4			4. S4 G4 Cm4 Cf4	4. G4 S4 Cm4 Cf4/Cy4

Bf
2 Bf4 Cm4 G4 S4/Bm4/By4

Appendix 14.3 contd.

Cm	Cf	G	P
Assam			
1. Cm3 Cf4 Cy4/G4		G4 Cm4 Cy4	P4 G4 Cf4 Cy4/Bf4/By4
2. Cm4 Cf4 Cy4/G4		G4 Cm4 Cf4 Cy4	
3. Cm4 P4 G4 Cf4/Cy4			
Meghalaya			
1. Cm4 Cf4 Cy4 P4/G4	Cf4 Cm4 Cy4 P4/G4		
Tripura			
1. Cm4 Cf4 Cy4/G4			
Manipur			
1. Cm4 Cf4 Cy4 P4			
Nagaland			
1.			P2 Cm4 Cf4
Mizoram			
1.			
2.			P2 Cf4 Cy4 P3 G4 Cf4/Cy4
Arunachal Pradesh			
1.			P1
2.			P2 Cm4/Cf4
3.			P3 G4 Cm4/Cf4

Note: For symbols please refer to paragraph 14.2.10

Appendix 14.3

Statement III - Livestock Patterns - All-India

(paragraph 14.3.13)

1. Cm3 Cf4 Cy4/G4/S4/Cy4 G4
2. Cm3 G4 Cf4/Cy4/Bf4
3. Cm3 Bf4 By4 Cf4/Cy4
4. Cm4 Cf4 Cy4/G4/P4/G4(Cy4/Bf4/P4)/Cy4 (Bf4/P4/G4/G4 Bf4)/ (Bf4 (Cf4/By4)
5. Cm4 Bf4(By4 G4)/Cf4(Cy4/G4)/By4/By4(G4/Cy4)/By4 G4(Cf4/Cy4/S4)
6. Cm4 G4 Cf4 Cy4/S4/Bm4
7. Cm4 Cf4 S4 Cy4/Bf4 Cy4
8. Cf3 S4 G4/Cy4/Bm4
9. Cf3 Cy3/Cy4 (Cm4/Bm4/S4/G4)
10. Cf4 Cm4 G4/Cy4/Cy4 (S4/G4/Bf4/P4)/G4 Bf4
11. Cf4 Cy4 Cm4/Cm4 Bf4/Cm4 Bm4/G4
12. Cf4 Bf4 G4/Cy4
13. Cy3 Cm4 G4/Cf4 S4
14. Cy4 Cm4 Cf4/Cf4 (Bf4/S4/G4)
15. Bf3 By4 Cm4/Cm4 G4
16. Bf4 S4 Cm4 Cf4/G4/G4 Cy4
17. Bf4 Cm4 G4/G4(Bm4/By4/By4 Cy4)/By4
18. Bf4 Cm4 Cf4 By4/By4 (S4/Cy4/G4)/S4 Cy4
19. Bf4 Cm4 By4 Bm4/S4
20. G3 Cm4 S4/Cf4/Cy4/Bf4/Cf4 (Cy4/S4)
21. G3 S3/S4/S4(Cf4/Cy4/D4/Cy4 Cm4/Cf4(Cy4/By4)
22. G4 S4 Cm4/Cf4/Cf4 Cm4/Cf4 Cy4/Cm4 Cy4/Cm4 Cy4 Bf4/ Cm4 Bf4 By4/Cy4 By4 Cf4/ Cy4 By4 Bf4

23. G4 Cm4 Cy4 Cf4/Bf4/Bf4 Cf4/Bf4 By4

24. G4 Cm4 Cf4/Bf4/Bf4 By4

25. S1

26. S2 Cm4/Cf4/G4

27. S3 G3/G4/G4(Cf4/Cm4/Bf4/Cy4/Cm4 Cf4/Cm4 Cy4/ Cf4 Cy4/Cf4 Cm4 Bf4)

28. S3 Cm4 Cf4/Bf4/Bf4 Cf4/Cf4 Cy4

29. S4 G4 Cm4 Cf4/Bf4/Cy4/Cy4 Bf4/Cy4 Cf4/Bf4 By4/Bf4 Cf4/
Bf4 Cf4 By4/Bf4 Cf4 Bm4

30. S4 G4 Cy4/Cf4/Bf4 By4/Cf4 Bm4/Cf4 Cy4

31. S4 Cm4 Cf4 Bf4/Cy4

32. P1

33. P2 Cm4/Cf4/Cf4 Cy4/Cm4 Cf4

34. P3 G4 Cf4/Cy4/Cm4

35. P4 G4 Cf4/Cy4/Bf4/By4

Note:- For symbols please refer to paragraph 14.2.10

APPENDIX 14.4

(Paragraph 14.4.1)

Statement I : Rainfall Patterns - Statewise

Notes:

(i) Serial numbers in column 1 represent numbers of Rainfall Zones of the concerned State. These are shown in Roman figures (I, II etc.).

(ii) Rainfall Pattern in column 2 is shown in three parts with the central in brackets. These cover four month periods (a) February to May, (b) June to September and (c) October to January. The coded form in each of the four month periods shows rainfall in decreasing order and not in calendar monthly sequence. In its decoded form according to calendar months, a blank entry indicates that rainfall in the concerned month is less than 5 cm except when any of the periods (a) to (c) has rainfall beginning with A or B type and in such cases the blank indicates rainfall of less than 10 cm. e.g. In A1 B2 E1, E is less than 10 cm and in C2 D1 E1, E signifies less than 5 cm.

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(iii) Number of months with rainfall greater than (a) 10 cm, (b) 20 cm and (c) 30 cm together with month of commencement. e.g. J!2 in column 17 indicates that for two consecutive months from July rainfall is greater than 20 cm per month. Information in columns 16 to 18 enables one to know the frequency or number of consecutive months with rainfall greater than 10, 20 and 30 cm respectively - symbols for months are:

symbol	month	symbol	month	symbol	month
Ja	January	My	May	S	September
F	February	Jn	June	O	October
Ma	March	Jl	July	N	November
Ap	April	Au	August	D	December

(iv) symbols in patterns indicate rainfall amounts as follows:

symbol	cm
A	greater than 30
B	20-30
C	10-20
D	5-10
E	less than 5 or less than 10 as explained in (ii) above

Subscript to symbol indicates number of months in which rainfall indicated by symbol lies.

(v) Geographical area figures in col 19 are based on reported areas of taluks except in Bihar, West Bengal and Assam where the areas refer to subdivisions, districts and police stations respectively.

(vi) Gross cropped area in col 21 refers in general to 1969-70

ANDHRA PRADESH

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm			Geographical area		Gross cropped area	
															10 cm	20 cm	30 cm	sq km	per cent to total	'000 ha	per-cent of total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
I	E4(D2E1)B2C1E1	156							D	D	D	B	B	C	03	02		6804	2.5	225	1.7
II	E4(C1D2E1)C2E2	145							D	D	C	C	C		S3			10432	3.3	336	2.6
III	E4(C1D2E1)B1C1E2	146							D	D	C	B	C		S3	01		3419	1.2	196	1.5
IV	E4(C1D2E1)B2E2	147							D	D	C	B	B		S3	02		4724	1.7	157	1.2
V	E4(C1D3)D1E3	136						D	D	D	C				S1			7014	2.5	418	3.2
VI	E4(C1D3)D2E2	137						D	D	D	C	D	D		S1			3062	1.1	146	1.1
VII	E4(C1D3)C2E2	138						D	D	D	C	C	C		S3			5545	2.0	124	0.9
VIII	E4(C1D3)A1B1C1E1	139						D	D	D	C	A	B		S4	02	01	4066	1.5	117	0.9
IX	E4(C2D2)D2E2	119						D	D	C	C	D	D		Au2			3237	1.2	159	1.2
X	E4(C2D2)C2E2	120						D	D	C	C	C	C		Au4			3536	1.3	51	0.4
XI	E4(C3D1)D1E3	112						D	C	C	C	D			J13			56821	20.7	3144	24.1
XII	E4(C3D1)C1D1E2	113						D	C	C	C	C	D		J14			5686	2.1	336	2.5
XIII	E4(C3D1)C2E2	114						D	C	C	C	C	C		J15			3018	1.4	342	2.6
XIV	E4(C4)C1D1E2	107						C	C	C	C	C	D		Jn5			6934	2.5	696	5.3
XV	E4(C4)B1C1E2	108						C	C	C	C	B	C		Jn5	01		6301	2.3	523	4.0

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	percent of total	Gross croppe area '000 ha	percen of total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
XVI	E4(B1C3)D1E3	094						C	B	C	C	D			Jn4	J11		35558	13.0	1745	13.3
XVII	E4(B1C3)C1^{D}1E2	095						C	B	C	C	C	D		Jn5	J11		7941	2.9	532	4.1
XVIII	E4(B2C2)D1E3	083						C	C	B	B	D			Jn4	J13		16488	6.0	531	4.1
XIX	E4(B3C1)D1E3	077						C		B	B	D			Jn4	J13		4936	1.8	218	1.7
XX	E4(A1B1C2)D1E3	065						C	A	B	C	D			Jn4	J12	J11	12705	4.6	471	3.6
XXI	E4(A2B1C1)D1E3	037						C	A	A	B	D			Jn4	J13	J12	4000	1.5	113	0.9
XXII	D1E3(C1D1E2)D1E3	150					D			D	C	D			S1			4962	1.8	279	2.1
XXIII	D1E3(C1D2E1)C1D1E2	148					D		D	D	C	C	D		S2			11261	4.1	412	3.2
XXIV	D1E3(C1D3)C2E2	141					D	D	D	D	C	C	C		S3			7008	2.6	259	2.0
XXV	D1E3(C2D2)C2D1E1	124					D	D	D	C	C	C	C	D	Au4			4790	1.7	140	1.1
XXVI	D1E3(C4)C1D1E2	109					D	C	C	C	C	C			Jn5			17225	6.3	995	7.6
XXVII	D2E2(B1C3)C1D1E2	097				D	D	C	B	C	C	C			Jn5	J11		3719	1.4	126	1.0
XXVIII	D2E2(B3C1)C1D1E2	031				D	D	C	B	B	B	C	D		Jn5	J13		6849	2.5	177	1.4
Special I	E4(A1B1C2)C1D1E2	069						C	A	B	C	D			Jn5	J12	J11	3105	1.1	43	0.3
Special II	E4(A2B2)D1E3	030						B	A	A	B	D			Jn4	J14	J12	1616	0.6	21	.2
Special III	D1E3(C2D2)C1D1E2	123				)	D	D	D	C	C	C	D		Au3			756	0.3	32	0.2

ASSAM

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	No. of months greater than 20 cm	No. of months greater than 30 cm	Geographical area sq km	Geographical area percent of total	Gross cropped area '000 ha	Gross cropped percent of total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
I	C1D1E2(A1B2C1)C1E3	059				D	C	B	A	B	C	C			My6	Jn3	Jl1	679	1.0	38	1.4
II	C1D1E2(A1C3)C1E3	073				D	C	C	A	C	C	C			My6	Jl1	Jl1	1133	1.7	23	0.8
III	C1D1E2(A2B2)C1E3	035				D	C	B	A	A	B	C			My6	Jl2	Jl2	471	0.7	26	0.9
IV	C1D2E1(B1C3)C1E3	096			D	D	C	C	B	C	C	C			My6	Jl1	-	795	1.2	44	1.6
V	B1C1E2(A1B2C1)D1E3	060				C	B	B	A	B	C	D			Ap6	My4	Jl1	2973	4.4	139	5.1
VI	B1C1E2(A2B1C1)D1E3	043				C	B	B	A	A	C	D			Ap6	My4	Jl2	1909	2.8	112	4.1
VII	B1C1E2(A3B1)C1E3	021				C	B	A	A	A	B	C			Ap7	My5	Jn3	7706	11.3	347	12.6
VIII	B1C1E2(A4)C1E3	007				C	B	A	A	A	A	C			Ap7	My5	Jn4	4522	6.6	186	6.8
IX	B2E2(A3B1)C1E3	023				B	B	A	A	A	B	C			Ap7	Ap6	Jn3	1934	2.8	74	2.7
X	B2C1E1(A4)C1E3	008			C	B	B	A	A	A	A	C			M8	Ap6	Jn4	7416	10.9	214	7.8
XI	A1C1E2(A2B1C1)D1E3	045				C	A	A	A	B	C	D			Ap6	My4	My3	1191	1.7	70	2.5
XII	A1C1E2(A3B1)C1E3	024				C	A	A	A	A	B	C			Ap7	My5	My4	9813	14.4	529	19.3
XIII	A1C1E2(A4)C1E3	009				C	A	A	A	A	A	C			Ap7	My5	My5	3444	5.0	152	5.5
XIV	A1B1E2(A4)C1E3	011				B	A	A	A	A	A	C			Ap7	Ap6	My5	11777	17.3	391	14.2

ASSAM

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	percent of total	Gross cropped area '000 ha	percent of total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	13	19	20	21	22
XV	A1B1C1E1(A1B3)C1D1E2	055			C	B	A	B	A	B	B	C	D		M8	Ap6	My1 J11	1879	2.8	38	1.4
XVI	A1B1C1E1(A4)C1E3	012			C	B	A	A	A	A	A	C			M8	Ap6	My5	1725	2.5	66	2.4
XVII	A2C1E1(A4)C1E3	013			C	A	A	A	A	A	A	C			M8	Ap6	Ap6	5557	8.1	209	7.6
XVIII	A2C1E1(A4)B1E3	014			C	A	A	A	A	A	A	B			M8	Ap7	Ap6	3265	4.8	90	3.3
																		68189		2748	

BIHAR

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	percent of total	Gross cropped area '000 ha	percent of total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		22
I	E4(B2C2)E4	082						C	B	B	C				Jn4	J12		3504	2.0	416	3.7
II	E4(B2C2)D1E3	083						C	B	B	C	D			Jn4	J12		2665	1.6	247	2.2
III	E4(A1B1C2)E4	064						C	A	B	C				Jn4	J12	J11	2629	1.5	201	1.8
IV	E4(A1B1C2)D1E3	065						C	A	B	C	D			Jn4	J12	J11	2012	1.2	231	2.1
V	E4(A1B2C1)E4	056						C	A	B	B				Jn4	J13	J11	1420	0.8	144	1.3
VI	E4(A1B2C1)D1E3	057						C	A	B	B	D			Jn4	J13	J11	15151	8.8	1,321	12.0
VII	E4(A2B1C1)E4	036						C	A	A	B				Jn4	J13	J12	4950	2.9	344	3.1
VIII	E4(A2B1C1)D1E3	037						C	A	A	B	D			Jn4	J13	J12	46147	26.8	2,237	20.2
IX	E4(A2B2)D1E3	030						B	A	A	B	D			Jn4	Jn4	J12	8354	5.1	380	3.4
X	D1E3(B2C2)D1E3	084					D	C	B	B	C	D			Jn4	J12		7672	4.5	522	4.7
XI	D1E3(A1B1C2)D1E3	066					D	C	A	B	C	D			Jn4	J12	J11	2431	1.4	93	0.8
XII	D1E3(A1B2C1)D1E3	058					D	C	A	B	B	D			Jn4	J13	J11	3475	2.0	304	2.8
XIII	D1E3(A2B1C1)D1E3	039					D	C	A	A	B	D			Jn4	J13	J12	14903	8.7	1,049.3	9.5
XIV	D1E3(A2B2)D1E3	031					D	B	A	A	B	D			Jn4	J14	J12	50133	29.1	3,059	27.8
XV	C1E3(A2B2)C1E3	034					C	B	A	A	B	C			My6	Jn4	J12	1782	1.0	104	0.9
XVI	C1E3(A3B1)D1E3	019					C	B	A	A	A	D			My5	Jn4	J13	2666	1.5	257.4	2.3
VII	C1E3(A4)D1E3	003					C	A	A	A	A	D			My5	Jn4	J14	1934	1.1	156	1.4
																		172,328		11,059	

Rainfall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	percent of total	Gross cropped area '000 ha	percent of total
1	2	3	4	5	6	7	3	9	10	11	12	13	14	15	16	17	13	19	20	21	22
I	E4(C1D1E2)E4	149							C	D					J11			21606	13.5	617	6.3
II	E4(C1D3)E4	135						D	C	D	D				J11			5796	3.6	446	4.5
III	E4(C2D1E1)E4	130							C	C	D				J12			11704	7.3	851	8.6
IV	E4(C2D2)E4	117						D	C	C	D				J12			8669	5.4	568	5.8
V	E4(B1C1E2)E4	104							E	C					J12	J11		36913	23.0	2504	25.5
VI	E4(B1C2E1)E4	099							E	C					J12	J11		16729	10.4	1136	11.6
VII	E4(B2E2)E4	091							E	B					J1	J12		4231	2.6	316	3.2
VIII	E4(B2C2)E4	032						C	E	B	C				Jn4	J12		5054	3.1	306	3.1
IX	E4(A1C3)E4	071						C	A	C	C				Jn4	J11	J11	9844	6.1	616	6.3
X	E4(A1B1C1E1)E4	061							A	B	C				J13	J12	J11	9558	6.0	714	7.3
XI	E4(A1B1C2)E4	064						C	A	B	C				Jn4	J12	J11	15950	9.9	1051	10.7
XII	E4(A2B1C1)E4	036						C	A	A	B				Jn4	J13	J12	7661	4.8	450	4.6
XIII	E4(A2B2)E4	029						B	A	A	B				Jn4	Jn4	J12	2195	1.4	110	1.1
XIV	E4(A3B1)E4	015						B	A	A	A				Jn4	Jn4	J13	4632	2.9	145	1.5
																		160542	..	9830	

HARYANA and PUNJAB

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	percent of total	Gross cropped area '000 ha	percent of total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	13	19	20	21	22
	HARYANA																				
I	E4(D3E1)E4	155							D	D	D				-	-	-	6656	15.1	722	14.7
II	E4(C2D1E1)E4	130							C	C	D				J12			19470	44.3	2320	47.3
III	E4(C3D1)E4	111						C	C	C	D				J13			14131	32.1	1540	31.4
IV	E4(B2C1E1)E4	086						B	B	C					J13	J11		3736	8.5	326	6.6
																		43993		4903	
	PUNJAB																				
I	E4(D2E2)E4	159							D	D					-	-	-	2738	5.4	235	4.3
II	E4(D3E1)E4	155							D	D	D				-	-	-	5231	10.4	582	10.6
III	E4(C2D1E1)E4	130							C	C	D				J12			25656	51.0	2939	54.4
IV	E4(C3D1)E4	111						D	C	C	C				J13			7629	15.2	396	16.3
V	E4(B1C2E1)E4	099							B	C	C				J13	J11		775	1.5	84	1.5
VI	E4(B2C1E1)E4	086							B	B	C				J13	J12		7340	14.6	645	11.7
VII	E4(A2C1E1)E4	050							A	A	C				J13	J12		936	1.9	68	1.2
																		50305		5499	

HIMACHAL PRADESH

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	percent of total	Gross cropped area '000 ha	percent of total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
I	E4(A2B1C1)C1D1E2	038	D					C	A	A	B	C			Jn5	J13	J12	2249	6.4	71	7.8
II	D1E3(A1B1C1E1)D1E3	062	D	D					A	B	C				J13	J12	J11	1132	3.2	55	6.0
III	D1E3(A1B1C1E1)D2E2	063	D		D				A	B	C	D			J13	J12	J11	2752	7.9	110	12.1
IV	D2E2(C2D2)D2E2	128	D	D	D			D	C	C	D	D			J12	-	-	387	1.1	41	4.5
V	D2E2(B1C2E1)D2E2	101	D	D	D				B	C	C	D			J13	J11	-	908	2.6	32	3.5
VI	D2E2(B2C1E1)D2E2	089	D	D	D				B	B	C	D			J13	J12	-	583	1.7	19	2.1
VII	D2E2(A2C1E1)D1E3	051	D	D	D				A	A	C				J13	J12	J12	4817	13.8	193	21.7
VIII	D2E2(A2C2)D1E3	048	D	D	D			C	A	A	C				Ja4	J12	J12	937	2.7	23	2.5
IX	D2E2(A2C2)D2E2	049	D	D	D			C	A	A	C	D			Jn4	J12	J12	2115	6.0	66	7.2
X	D2E2(A2B1C1)D2E2	045	D	D	D			C	A	A	B	D			Jn4	J13	J12	1266	3.6	55	6.0
XI	D3E1(B1C2E1)C1D1E2	103	C	D	D	D			B	C	C	D			Ja1	J11	-	827	2.3	23	2.5
XII	D4(E4)D1E3	173	D	D	D	D	D								-	-	-	3619	10.4	6	0.7
XIII	D4(E4)C1D1E2	174	C	D	D	D	D					D			Ja1	-	-	70	0.2	5	0.5
XIV	D4(B2C1E1)D1E3	090	D	D	D	D	D		B	B	C				J13	J12	-	2715	7.8	27	0.6
XV	C1D3(D3E1)C1D1E2	158	C	C	D	D	D		D	D	D	D			Ja2			28	0.1	2	0.2
XVI	C1D3(B1C2E1)C2D1E1	102	C	C	D	D	D		B	C	C	C		D	Ja2 J12	J11	-	2845	8.1	35	3.8
XVII	C2D2(C2D2)C1E3	129	C	C	C	D	D	D	C	C	D				Ja3 J12			4600	13.2	34	3.7
XVIII	C2D2(A2B1C1)C2D1E1	042	C	C	C	D	D	C	A	A	B	C		D	Ja3 Jn5	J13	J12	3105	8.9	110	12.1
																		34960		912	

JAMMU and KASHMIR

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	No. of months greater than 20 cm	No. of months greater than 30 cm	Geographical area sq km	Geographical area percent of total	Gross cropped area '000 ha	Gross cropped area percent of total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
I	E4(E4)E4	169																572	2.4	18	2.1
II	D1E3(B2C1E1)D1E3	037	D		D				B	B	C				J13	J12		402	1.7	54	6.2
III	D2E2(B2E2)D1E3	092	D	D	D				B	B					J1	J1		1127	4.7	23	2.7
IV	D2E2(A2C1E1)D1E3	051	D	D	D				A	A	C				J113	J12	J12	5525	22.8	201	23.2
V	D4(D2E2)D1E3	163	D	D	D	D	D		D	D					-	-	-	2931	12.1	197	22.7
VI	C1D1E2(A2C1E1)C1D1E2	052	C	C	D				A	A	C			D	Ja2 -J13	J12	J12	3256	13.5	70	8.1
VII	C2D1E1(A2C1E1) C1D1E2	053	C	C	C	D			A	A	C			D	Ja3 -J13	J12	J12	2484	10.3	51	5.9
VIII	C2D2(C2D2)C1D1E2	127	C	C	C	D	D	D	C	C	D			D	Ja3 -J12	-	-	2470	10.2	41	4.7
IX	C2D2(B2C1E1)C1D1E2	083	C	C	C	D	D		B	B	C			D	Ja3 -J13	J12	J12	1143	4.7	29	3.3
X	C3D1(D1E3)C1D1E2	168	C	C	C	C	D			D				D	Ja4	-	-	1370	5.7	95	11.0
XI	C3D1(D3E1)C1D1E2	157	C	C	C	C	D		D	D	D			D	Ja4	-	-	2153	8.9	50	5.8
XII	C3D1(D4)C1D1E2	154	C	C	C	C	D	D	D	D	D			D	Ja4	-	-	750	3.0	37	4.3
																		24183	.	866	.

KARNATAKA

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	per cent of total	Gross cropped area '000 ha	percent of total
I	E4(C1D3)D1E3	136						D	D	D	C	D			S1			18,422	9.6	1,532	14.2
II	E4(C3D1)D1E3	112						D	C	C	C	D			Jl3			10,496	5.5	732	7.2
III	E4(C4)D1E3	106						C	C	C	C	D			Jn4			10,892	5.7	856	7.9
IV	E4(B1C3)D1E3	094						C	C	C	B	D			Jn4	S1		5,451	2.8	407	3.8
V	D1E3(D2E2)C1D1E2	166					D			D	D	C	D		D1			3,763	2.0	134	1.2
VI	D1E3(C1D3)D1E3	142					D	D	D	D	C	D			S1			30,427	15.9	2,236	21.2
VII	D1E3(C1D3)C1D1E2	143					D	D	D	D	C	C	D		S2			24,063	12.6	1,139	10.5
VIII	D1E3(C2D2)C1E3	122					D	D	D	C	C				Au3			7,499	3.9	616	5.7
IX	D1E3(C2D2)C1D1E2	123					D	D	D	C	C	C	D		Au3			10,252	5.3	491	4.5
X	D1E3(C3D1)C1E3	115					D	D	C	C	C	C			Jl4			2,641	1.4	190	1.8
XI	D1E3(B1C2E1)C1E3	100					D	B	C	C	E				Jl4	Jl1		6,078	3.2	232	2.6
XII	D1E3(A1B1C2)C1E3	067					D	C	A	B	C	C			Jn5	Jl2	Jl1	2,985	1.6	113	1.0
XIII	D1E3(A3C1)C1E3	025					D	C	A	A	A	C			Jn4	Jl3	Jl3	4,941	2.6	65	0.6
XIV	D1E3(A3C1)C1D1E2	026					D	A	A	A	C	C	D		Jn5	Jn3	Jn3	3,813	2.0	53	0.5
XV	D1E3(A3B1)C1E3	017					D	A	A	A	B	C			Jn5	Jn4	Jn3	732	0.4	11	0.1

KARNATAKA (contd.)

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	percent of total	Gross cropped area '000 ha	percent of total
XVI	D1E3(A3B1)C1D1E2	018					D	A	A	A	B	C	D		Jn5	Jn4	Jn3	6492	3.4	103	1.0
XVII	D1E3(A4)C1D1E2	002					D	A	A	A	A	C	D		Jn5	Jn4	Jn4	1687	0.9	27	0.3
XVIII	D2E2(A2B1C1)C1D1E2	041				D	D	B	A	A	C	C	D		Jn5	Jn3	J12	814	0.4	9	0.1
XIX	C1E3(C1D1E2)C1D1E2	151					C			D	C	C	D		My1	S2		4066	2.1	239	2.2
XX	C1E3(C2D2)C1D1E2	126					C	D	D	C	C	C	D		My1	Au3		4021	2.1	190	1.8
XXI	C1E3(A4)C1D1E2	004					C	A	A	A	A	C	D		My6	Jn4		3758	2.0	165	1.5
XXII	C1E3(A4)B1C1E2	005					C	A	A	A	A	B	C		My7	Jn5	Jn4	4623	2.4	105	1.0
XXIII	C1D1E2(D2E2) C1D1E2	164				D	C			D	D	C	D		My1	D1		2637	1.4	127	1.2
XXIV	C1D1E2(C1D3) C1D1E2	144				D	C	D	D	D	C	C	D		My1	D2		14806	7.7	676	6.3
XXV	C1D1E2(A3C1) C1D1E2	027				D	C	A	A	A	C	C	D		My6	Jn3	Jn3	3705	1.9	135	1.3
XXVI	C1D1E2(A4)C1D1E2	006				D	C	A	A	A	A	C	D		My6	Jn4	Jn4	2279	1.2	59	0.5
																		191,343		10,793	

KERALA

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	percent of total	Gross cropped area '000 ha	percent of total
I	C1D1E2(B1C3)B2E2	098				D	C	B	C	C	C	B	B		My7	Jn102		571	1.5	61	2.1
II	B1C1E2(A1B1C2)B1C1E2	068				C	B	A	B	C	C	B	C		Ap8	My301	Jn1	1615	4.2	182	6.2
III	B1C1E2(A2B1C1)B1C1E2	044				C	B	A	A	B	C	B	C		Ap8	My401	Jn2	592	1.5	11	0.4
IV	B1C1E2(A3B1)A1B1E2	022				C	B	A	A	A	B	A	B		Ap8	My7	Jn301	8769	22.8	763	26.0
V	A1C1E2(A4)A1B1E2	010				C	A	A	A	A	A	A	B		Ap8	My7	My6	4557	11.8	285	9.7
VI	C1D1E2(A3C1)B1C1E2	028				D	C	A	A	A	C	B	C		My7	Jn301	Jn3	4037	10.5	326	11.1
VII	B1E3(A3B1)B1C1E2	020					B	A	A	A	B	B	C		My7	My6	Jn3	16887	43.8	1221	41.7
VIII	C2D1E1(B2C2)B1C1E2	085			D	C	C	B	B	C	C	B	C		Ap8	Jn29		1071	2.8	41	1.4
IX	D2E2(C4)B2C1E1	110				D	D	C	C	C	C	B	B	C	Ju7	O2		443	1.1	41	1.4
																		38542		2931	

MADHYA PRADESH

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	percent of total	Gross cropped area '000 ha	percent of total
I	E4(C4)E4	105						C	C	C	C			Jn4			4,211	1.1	279	1.4
II	E4(B1C3)E4	093						C	B	C	C			Jn4	Jl1		12,303	3.3	847	4.2
III	E4(B2 C1 E1)E4	036							B	B	C			Jl3	Jl2		46,939	12.8	2,348	11.6
IV	E4(B2 C2)E4	032						C	B	B	C			Jn4	Jl2		25,952	7.1	1712	8.5
V	E4(A1 B1 C1 E1)E4	061							A	B	C			Jl3	Jl2	Jl1	9,179	2.5	532	2.6
VI	E4(A1 B1 C2)E4	064						C	A	B	C			Jn4	Jl2	Jl1	28,760	7.8	1,580	7.9
VII	E4(A1 B1 C2)D1E3	065						C	A	B	C	D		Jn4	Jl2	Jl1	3,925	1.1	324	1.6
VIII	E4(A2 C1 E1)E4	050							A	A	C			Jl3	Jl2	Jl2	24,773	6.7	1,258	6.3
IX	E4(A2 C2)E4	046						C	A	A	C			Jn4	Jl2	Jl2	67,353	18.3	3,693	18.4
X	E4(A2 C2)D1E3	047						C	A	A	C	D		Jn4	Jl2	Jl2	17,768	4.8	1,350	6.7
XI	E4(A2 B1 C1)E4	036						C	A	A	B			Jn4	Jl3	Jl2	24,908	6.8	1,234	6.1
XII	E4(A2 B1 C1)D1E3	037						C	A	A	B	D		Jn4	Jl3	Jl2	26,515	7.2	1,302	6.5
XIII	E4(A2 B2)D1E3	030						B	A	A	B			Jn4	Jn4	Jl2	75,289	20.5	3,858	18.2
																	367,880		20,317	

MAHARASHTRA

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	percent of total	Gross cropped area '000 ha	percent of total
I	E4(C1D3)D1E3	136						D	D	D	C	D			S1			26002	8.5	1961	10.6
II	E4(C2D2)D1E3	118						C	D	D	C	D			Jn1	S1		16950	5.6	1261	6.8
III	E4(C3D1)E4	111						C	C	D	C				Jn2	S1		15821	5.2	1098	5.9
IV	E4(C4)E4	105						C	C	C	C				Jn4			47465	15.6	3824	20.7
V	E4(C4)D1E3	106						C	C	C	C	D			Jn4			2819	0.9	143	0.8
VI	E4(B1C3)E4	093						C	B	C	C				Jn4	J11		71879	23.6	5073	27.5
VII	E4(B1C3)D1E3	094						C	B	C	C	D			Jn4	J11		6279	2.1	281	1.5
VIII	E4(B2C2)E4	082						C	B	B	C				Jn4	J12		7208	2.4	560	3.0
IX	D1E3(A1C3)C1E3	072					D	C	A	C	C	C			Jn5	J11		5622	1.8	262	1.4
X	E4(A1B1C2)E4	064						C	A	B	C				Jn4	J12	J11	961	0.3	57	0.3
XI	E4(A1B1C2)D1E3	065						C	A	B	C	D			Jn4	J12	J11	29754	9.8	1862	10.1
XII	E4(A2B1C1)D1E3	037						C	A	A	B	D			Jn4	J13	J12	9915	3.3	305	1.7
XIII	E4(A2B2)D1E3	030						B	A	A	B	D			Jn4	J14	J12	31293	10.3	1026	5.6
XIV	D1E3(A3C1)C1E3	025					D	C	A	A	A	C			Jn5	J13	J13	965	0.3	27	0.2
XV	E4(A3B1)D1E3	016						B	A	A	A	D			Jn4	Jn4	J13	5060	1.7	133	0.7
	E4(A4)C1E3	001						A	A	A	A	C			Jn5	Jn4	Jn4	26225	8.6	583	3.2
																		304218		18461	

ORISSA

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	per cent of total	Gross cropped area '000 ha	per cent of total
I	E4(A2B2)D1E3	030						B	A	A	B	D			Jn4	Jn4	J12	51,885	33.3	1,985	31.3
II	D1E3(C4)C1D1E2	109					D	C	C	C	C	C	D		Jn5			767	0.5	65	1.0
III	D1E3(B3C1)C1D1E2	079					D	C	B	B	B	C	D		Jn5	J13		6,079	3.9	131	2.1
IV	D1E3(B3C1)C1E3	078					D	C	B	B	B	C			Jn5	J13		12,592	8.1	577	9.1
V	D1E3(B4)C1E3	074					D	B	B	B	B	C			Jn5	Jn4		2,827	1.8	165	2.7
VI	D1E3(A1B3)C1E3	054					D	B	A	B	B	C			Jn5	Jn4	J11	3,508	2.3	274	4.4
VII	D1E3(A2B2)D1E3	031					D	B	B	A	A		D		Jn4	Jn4	J12	33,376	21.4	863	13.6
VIII	D1E3(A2B2)C1E3	032					D	B	A	A	B	C			Jn5	J13	J12	18,309	11.7	916	14.4
IX	D1E3(A2B2)C1D1E2	033					D	B	A	A	B	C	D		Jn5	Jn4	J12	4,894	3.1	479	7.5
X	D1E3(A3B1)C1E3	017					D	B	A	A	A	C			Jn5	Jn4	J13	7,768	5.0	249	3.9
XI	D2E2(B4)C1D1E2	075				D	D	B	B	B	B	C	D		Jn5	Jn4		3,304	2.1	56	0.9
XII	C1D1E2(A2B2)C1E3	035				D	C	B	A	A	B	C			Jn5	Jn4	J12	10,528	6.8	577	9.1
																		155,837		6,337	

RAJASTHAN

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	per cent of total	Gross cropped area '000 ha	per cent of total
I	E4(D2E2)E4	159							D	D					-	-	-	113,562	33.3	2,551	17.9
II	E4(C1D1E2)E4	149							C	D					J11			16,053	4.7	286	2.0
III	E4(C2D1E1)E4	130							C	C	D				J12			76,209	22.3	4,704	33.0
IV	E4(C2D2)E4	117						D	C	C	D				J12			24,331	7.1	1,234	8.6
V	E4(C3D1)E4	111						D	C	C	C				J13			14,345	4.2	1,211	8.5
VI	E4(B1C1E2)E4	104							B	C					J12	J11		17,502	5.1	446	3.1
VII	E4(B2E2)E4	091							B	B					J12	J12		22,724	6.7	1,107	7.8
VIII	E4(B2C1E1)E4	086							B	B	C				J13	J12		36,618	10.7	1,776	12.5
IX	E4(A1B1C1E1)E4	061							A	B	C				J13	J12	J11	4,276	1.3	223	1.6
X	E4(A2C1E1)E4	050							A	A	C				J13	J12	J12	14,545	4.3	700	4.9
XI	E4(A1B1E2)E4	070							A	B					J12	J12	J11	898	0.3	15	0.1
																		341,053		14,253	

TAMIL NADU

Rain-fall zone no. (State)	Rainfall Pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	Per cent of total	Gross cropped area '000 ha	Per cent of total
I	E4(C2D1E1)A1B1C1E1	131							D	C	C	B	A	C	Au5	02	N1	4,458	3.5	321	4.6
II	D1E3(C1D1E2)A1B1C1E1	153					D			D	C	B	A	C	S4	02	N1	1,485	1.2	145	2.1
III	E4(D2E2)A1B2E1	160								D	D	B	A	B	03	03	N1	1,907	1.5	127	1.8
IV	D1E3(C2D1E1)B1C1E2	133					D		D	C	C	C	B		Au4	N1		1,940	1.5	126	1.8
V	D1E3(C2D1E1)B1C2E1	134					D		D	C	C	C	B	C	Au5	N1		7,305	5.8	522	7.5
VI	D1E3(E4)B1C2E1	172					D					C	B	C	03	N1		5,662	4.5	192	2.8
VII	E4(C2D2)B2C1E1	121						D	D	C	C	B	B	C	Au5	02		8,214	6.5	508	7.3
VIII	E4(E4)C2D1E1	170										C	C	D	02			938	0.7	47	0.7
IX	D1E3(C2D2)C1D1E2	123					D	D	D	C	C	C	D		02			2,525	2.0	142	2.0
X	D1E3(E4)C2E2	171					D					C	C		02			4,690	3.7	278	4.0
XI	D1E3(D2E2)C2D1E1	161					D			D	D	C	C	D	02			6,380	5.0	369	5.3
XII	D1E3(C1D1E2)C2D1E1	152					D			D	C	C	C	D	S3			5,828	4.6	356	5.1
XIII	D1E3(C2D1E1)C2D1E1	132					D		D	C	C	C	C	D	Au4			9,230	7.3	441	6.4
XIV	D1E3(C2D2)C2D1E1	124					D	D	D	C	C	C	C	D	Au4			16,031	12.7	722	10.4
XV	D2E2(D2E2)C2E2	165				D	D			D	D	C	C		02			7,237	5.7	351	5.1

(contd.)

TAMIL NADU (concld.)

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	per cent of total	Gross cropped area '000 ha	per cent of total
XVI	D2E2(D1E3)C2D1E1	167				D	D				D	C	C	D	02			13,185	10.4	719	10.3
XVII	D2E2(D2E2)C2D1E1	162				D	D			D	D	C	C	D	O2			6,759	5.3	341	4.9
XVIII	D2E2(C2D2)C2D1E1	125				D	D	D	D	C	C	C	C	D	Au4			3,761	3.0	186	2.7
XIX	C1E3(C1D3)C1D1E2	140					C	D	D	D	C	C	D		May1 S2			3,061	2.4	115	1.7
XX	C1E3(C2D2)C1D1E2	126					C	D	D	C	C	C	D		May1 Au3			8,887	7.0	605	8.7
																		119,483		5,613	
Special rainfall patterns (9)																		7,275	5.7	334	4.8
																		126,758		5,947	

UTTAR-PRADESH

Rain-fall zone no. (State)	Rainfall pattern	All India zone-no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than			Geographical area		Gross cropped area	
															10 cm	20 cm	30 cm	sq km	percent of total	'000 ha	percent of total
I	E4(C3E1)E4	116							C	C	C				J13			5856	2.4	635	2.9
II	E4(C3D1)E4	111						D	C	C	C				J13			17182	7.2	1950	8.8
III	E4(B1C2E1)E4	099							B	C	C				J13	J11		7300	3.3	743	3.4
IV	E4(B2C1E1)E4	086							B	B	C				J13	J12		96391	40.5	8594	39.0
V	E4(B2C2)E4	082						C	B	B	C				Jn4	J12		10493	4.4	974	4.4
VI	E4(B3C1)E4	076						C	B	B	B				Jn4	J13		2082	0.9	214	1.0
VII	E4(B3C1)D1E3	077						C	B	B	B	D			Jn4	J13		2536	1.1	273	1.2
VIII	E4(A1B1C1E1)E4	061							A	B	C				J13	J12	J11	9708	4.1	569	2.6
IX	E4(A1B1C2)E4	064						C	A	B	C				Jn4	J12	J11	5732	2.4	570	2.6
X	E4(A1B2C1)E4	056						C	A	B	B				Jn4	J13	J11	15758	6.6	1533	7.0
XI	E4(A2C1E1)E4	050							A	A	C				J13	J12	J12	18141	7.6	1437	6.5
XII	E4(A2C2)E4	046						C	A	A	C				Jn4	J12		6370	2.7	401	1.8
XIII	E4(A2B1C1)E4	036						C	A	A	B				Jn4	J13	J12	14027	5.9	1296	5.9
XIV	E4(A2B1C1)D1E3	037						C	A	A	B	D			Jn4	J13	J12	26016	10.9	2851	12.9
																		238097		22040	

WEST BENGAL

Rain-fall zone no. (State)	Rainfall pattern	All India zone no.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No. of months greater than 10 cm	20 cm	30 cm	Geographical area sq km	percent of total	Gross cropped area '000 ha	percent of total
I	D1E3(A2B1C1)D1E3	039					D	B	A	A	C	D			Jn4	Jn3	J12	13,140	15.0	729	10.3
II	C1E3(B3C1)D1E3	080					C	B	B	B	C	D			My5	J13		20,845	23.7	2,167	30.5
III	C1E3(A2B2)C1E3	034					C	B	A	A	B	C			My5	J14	J12	8,919	10.1	1,070	15.1
IV	C1D1E2(A2B2)C1E3	035				D	C	B	A	A	B	C			My6	Jn4	J12	32,243	36.7	2,292	32.2
V	B1C1E2(A4)C1E3	007				C	B	A	A	A	A	C			Ap7	My5	Jn4	3,075	3.5	117	1.6
VI	A1C1E2(A4)C1E3	009				C	A	A	A	A	A	C			Ap7	My5	My5	9,631	11.0	734	10.3
																		87,853		7,109	

APPENDIX 14.4

(Paragraph 14.4.2)

Statements II to IV - Geographical (reporting) Areas under each of the Rainfall Patterns of (i) June to September (ii) February to May and (iii) October to January.

Notes:

1. The Union Territories and the Eastern States of Maghalaya, Nagaland, Manipur and Tripura which account for about 5.5 per cent of the reporting area of the country have not been considered in the tables due to inadequacy of rainfall data and as some of them have large hill-areas.

2. Areas shown against different rainfall patterns in each of the seventeen States listed in Statements II to IV are based on taluk data on area except in Bihar, West Bengal and Assam where sub-division, district and police station are the respective units of area.

3. The geographical areas shown in the Statements represent reporting areas. The total of reporting areas in some of the States in the Statements II to IV differ from published figures due to exclusion of (a) hill areas in west Uttar Pradesh, Tamil Nadu (Nilgiris) etc, (b) certain forest areas from taluk areas in Madhya Pradesh and (c) some areas in Gujarat. Rainfall data is also inadequate for zoning these areas. Details of area under (1) and (3) are given in 4.

4.

	Million sq km
Total Reporting area (1969-70)	3.06
Area under (1) above	0.17
Area of remaining seventeen States	2.89
Area under (3) above	0.21
Total of seventeen States in Statements II to IV	2.68

सत्यमेव जयते

5 The total area shown against each pattern in col.20 is the total of the areas under each of the States (cols.3 to 19). Col.21 shows the areas in col.20 as per cent to all India total given at the bottom of the column.

APPENDIX 14.4

(Paragraph 14.4.2)

Statement II Geographical (reporting) area under each of the Rainfall Patterns of June to September.

(Sq. Km.)

S. No.	South West Monsoon patterns	Assam	West Bengal	Orissa	Bihar	Uttar Pradesh	Himachal Pradesh	Jammu & Kashmir	Punjab	Haryana	Rajasthan
1	2	3	4	5	6	7	8	9	10	11	12
1.	A4	37,706	12,706		1,934						
2.	A3B1	19,453		7,768	2,666						
3.	A3C1										
4.	A2B2	471	41,152	118,992	60,769						
5.	A2B1C1	3,100	13,140		66,000	40,043	6,620				
6.	A2C2					6,370	3,052				
7.	A2C1E1					18,141	4,817	11,265	936		14,545
8.	A1B3	1,879		3,508							
9.	A1B2C1	3,652			20,046	15,758					
10.	A1B1C2				7,072	5,732					
11.	A1B1C1E1					9,708	3,884				4,276
12.	A1B1E2										898
13.	A1C3	1,133									
14.	B4			6,131							
15.	B3C1		20,845	18,671		4,618					
16.	B2C2				13,841	10,498					
17.	B2C1E1					96,391	3,303	1,545	7,340	3,736	36,618
18.	B2E2							1,127			22,724

Appendix 14.4 - Statement II (contd.)

1	2	3	4	5	6	7	8	9	10	11	12
19.	B1C3	795									
20.	B1C2E1					7,300	4,580		775		
21.	B1C1E2										17,502
22.	C4			767							
23.	C3D1					17,182			7,629	14,131	14,345
24.	C3E1					5,856					
25.	C2D2						4,987	2,470			24,831
26.	C2D1E1								25,656	19,470	76,209
27.	C2E2										
28.	C1D3										
29.	C1D2E1										
30.	C1D1E2										16,053
31.	D4							750			
32.	D3E1						28	2,158	5,231	6,656	
33.	D2E2							2,931	2,738		113,562
34.	D1E3							1,370			
35.	E4						3,689	572			
	Total	68,189	87,853	155,837	1,72,328	238,097	34,960	24,188	50,305	43,993	341,063

Appendix 14.4 - **Statement II (contd.)**

S. No.	South West Monsoon Patterns	Gujarat	Madhya Pradesh	Maha-rashtra	Andhra Pradesh	Kar-nataka	Tamil Nadu	Kerala	Total	Per cent of total (col.20)
1	2	13	14	15	16	17	13	19	20	21
1.	A4			26,225		12,347		4,557	95,475	3.56
2.	A3B1	4,632		5,060		7,224	722	25,656	73,181	2.77
3.	A3C1			965		12,459		4,037	17,461	0.65
4.	A2B2	2,195	75,289	31,293	1,616				331,787	12.38
5.	A2B1C1	7,661	51,423	9,915	4,000	314		592	203,308	7.57
6.	A2C2		[illegible]						94,543	3.53
7.	A2C1E1		[illegible]						74,482	2.78
8.	A1B3								5,387	0.20
9.	A1B2C1								39,456	1.47
10.	A1B1C2	15,950	32,685	30,715	15,810	2,985		1,615	112,564	4.20
11.	A1B1C1E1	9,558	9,179						36,605	1.37
12.	A1B1E2			85,121					898	0.03
13.	A1C3	9,844		5,622					16,599	0.62
14.	B4								6,131	0.23
15.	B3C1				11,785				55,919	2.08
16.	B2C2	5,054	25,952	7,208	16,488			1,071	80,112	2.98
17.	B2C1E1		46,939						195,872	7.31
13.	B2E2	4,231							28,082	1.05
19.	B1C3		12,303	78,158	47,218	5,451	431	571	144,927	5.41
20.	B1C2E1	16,729				6,078			35,962	1.34

Appendix 14.4 (co

Appendix 14.4 (Contd.)

S. No.	Rainfall Pattern	Gujarat	Madhya Pradesh	Maharashtra	Andhra Pradesh	Karnataka	Tamil Nadu.	Kerala	total	per cent to total of col.20
1	2	13	14	15	16	17	18	19	20	21
1.	E4	160542	367880	297631	217848	45261	15517		1920175	71.63
2.	D1 E3			6587	46002	105373	62912		407034	15.18
3.	D2 E2				10568	814	31313	443	64612	2.41
4.	D3 E1						1226		2053	0.08
5.	D4								9335	0.35
6.	C1 E3					16468	11948		64562	2.41
7.	C1 D1 E2					23427	1920	4608	78265	2.92
8.	C1 D2 E1								795	0.03
9.	C1 D3								2873	0.11
10.	C2 E2						431		431	0.02
11.	C2 D1 E1						366	1071	3921	0.15
12.	C2 D2						625	11943	11943	0.45
13.	C3 D1								4278	0.16
14.	B1 E3							16887	16887	0.63
15.	B1 C1 E2							10976	31161	1.16
16.	B2 E2								1934	0.07
17.	B2 C1 E1								7416	0.28
18.	A1 C1 E1							4557	28636	1.07
19.	A1 B1 E2								11777	0.44
20.	A1 B1 C1 E1									3.04
21.	A2 C1 E1								8822	0.33
	Total	160542	367880	304218	274418	191343	126758	38542	2680514	

APPENDIX 14.4

(Paragraph 14.4.2)

Statement III - Geographical (reporting) Area under each Rainfall Patterns of February to May.

(sq km)

S. No.	Rainfall pattern	Assam	West Bengal	Orissa	Bihar	Uttar Pradesh	Himachal Pradesh	Jammu & Kashmir	Punjab	Haryana	Rajasthan
1	2	3	4	5	6	7	8	9	10	11	12
1.	E4			51885	87332	238097	2249	572	50305	43993	341063
2.	D1 E3		13140	90120	78614		3884	402			
3.	D2 E2			3304			11018	6652			
4.	D3E1						827				
5.	D4						6404	2931			
6.	C1 E3		29764		6382						
7.	C1 D1 E2	2283	32243	10528				3256			
8.	C1 D2 E1	795									
9.	C1 D3						2873				
10.	C2 E2										
11.	C2 D1 E1							2484			
12.	C2 D2						7705	3613			
13.	C3 D1							4278			
14.	B1 E3										
15.	B1 C1 E2	17110	3075								
16.	B2 E2	1934									
17.	B2 C1 E1	7416									
18.	A1 C1 E1	[illegible]	9631								
19.	A1 B1 E2	11777									
20.	A1 B1 C1 E1	3604									
21.	A2 C1 E1	8822									
	Total	68189	87853	155837	172328	238097	34960	24188	50305	43993	341063

Appendix 14.4 - Statement III (contd.)

S. No.	Rainfall Pattern	Gujarat	Madhya Pradesh	Maha-rashtra	Andhra Pradesh	Karna-taka	Tamil Nadu	Kerala	total	per cent to total of col.20
1	2	13	14	15	16	17	18	19	20	21
1.	E4	160542	367880	297631	217848	45261	15517		1920175	71.63
2.	D1 E3			6587	46002	105373	62912		407034	15.18
3.	D2 E2				10568	814	31813	443	64612	2.41
4.	D3 E1						1226		2053	0.08
5.	D4								9335	0.35
6.	C1 E3					16468	11948		64562	2.40
7.	C1 D1 E2					23427	1920	4608	78265	2.92
8.	C1 D2 E1								795	0.03
9.	C1 D3								2873	0.11
10.	C2 E2						431		431	0.02
11.	C2 D1 E1						366	1071	3921	0.15
12.	C2 D2						625	[illegible]	11943	0.45
13.	C3 D1								4278	0.16
14.	B1 E3							16887	16887	0.63
15.	B1 C1 E2							10976	31161	1.16
16.	B2 E2								1934	0.07
17.	B2 C1 E1								7416	0.28
18.	A1 C1 E1							4557	28636	1.07
19.	A1 B1 E2								11777	0.44
20.	A1 B1 C1 E1								3604	0.13
21.	A2 C1 E1								8822	0.33
	Total	160542	367880	304218	274418	191343	126758	38542	2680514	

APPENDIX 14.4

(Paragraph 14.4.2)

Statement IV - Geographical (reporting) Area under each of the Rainfall Pattern of October to January.

(sq km)

S. No.	Rainfall Patterns	Assam	West Bengal	Orissa	Bihar	Uttar Pradesh	Himachal Pradesh	Jammu & Kashmir	Punjab	Haryana	Rajasthan
1	2	3	4	5	6	7	8	9	10	11	12
1	E4				12503	209545		572	50305	43993	341063
2.	D1 E3	6073	33985	85261	158043	28552	13220	9985			
3.	D2 E2						8016				
4.	C1 E3	56972	53868	55532	1732		4600				
5.	C1 D1 E2	1879		15044			3174	13631			
6.	C2 D1 E1						5950				
7.	C2 E2										
8.	B1 E3	3265									
9.	B1 C1 E2										
10.	B1 C2 E1										
11.	B2 E2										
12.	B2 C1 E1										
13.	A1 B1 E2										
14.	A1 B1 C1 E1										
15.	A1 B2 E1										
Total		68189	87853	155837	172328	238097	34960	24188	50305	43993	341063

Appendix 14.4 -Statement IV (contd.)

S. No.	Rainfall Patterns	Gujarat	Madhya Pradesh	Maharashtra	Andhra Pradesh	Karnataka	Tamil Nadu	Kerala	total	per cent to total of col.20
1	2	13	14	15	16	17	18	19	20	21
1.	E4	160542	244,383	143334					1206240	45.00
2.	D1 E3		123497	128072	144100	75688			806476	30.09
3.	D2 E2				6299				14315	0.53
4.	C1 E3			32812		24376			230442	8.60
5.	C1 D1 E2				63476	86156	12134		195494	7.29
6.	C2 D1 E1				4790		66044		76784	2.86
7.	C2 E2				23426		13763		37189	1.39
8.	B1 E3								3265	0.12
9.	B1 C1 E2				16733	4623	1940	24202	47498	1.77
10.	B1 C2 E1						14193		14193	0.53
11.	B2 E2				4724		1995	571	7290	0.27
12.	B2 C1 E1				6804		8214	443	15461	0.58
13.	A1 B1 E2							13326	13326	0.50
14.	A1 B1 C1 E1				4066		6568		10634	0.40
15.	A1 B2 E1						1907		1907	0.07
	Total	160542	367880	304218	274418	191343	126758	38542	2680514	

APPENDIX 14.4

(Paragraph 14.4.3)

Statement V - Gross Cropped Area under each of the Rainfall Patterns of (June-September) - 1969-70.

(thousand hectares)

S. No.	Patterns	Assam	West Bengal	Orissa	Bihar	Uttar Pradesh	Himachal Pradesh	Jammu & Kashmir	Punjab	Haryana	Rajasthan
1	2	3	4	5	6	7	8	9	10	11	12
1.	A4	1,308	851		156						
2.	A3B1	950	-	249	257						
3.	A3C1										
4.	A2B2	26	3,362	4,820	3,543						
5.	A2B1C1	182	729		3,630	4,147	236				
6.	A2C2					401	89				
7.	A2C1E1					1,437	193	322	68		700
8.	A1B3	33	-	274							
9.	A1B2C1	177	-	-	1,769	1,533					
10.	A1B1C2				525	570					
11.	A1B1C1E1					569	165				223
12.	A1B1E2										15
13.	A1C3	23									
14.	B4			221							
15.	B3C1	-	2,167	708		487					
16.	B2C2				1,179	974					
17.	B2C1E1					8,594	46	83	645	326	1,776
18.	B2E2							23			1,107
19.	B1C3	44									
20.	B1C2E1					743	90		84		
21.	B1C1E2										446
22.	C4			65							
23.	C3D1					1,950			896	1,540	1,211
24.	C3E1					635					
25.	C2D2						75	41			1,234

contd.

(Appendix 14.4 - Statement V (contd.)

S. No.	Patterns	Gujarat*	Madhya Pradesh	Maharashtra	Andhra Pradesh	Karnataka	Tamil Nadu	Kerala	total	per cent to all-India
1.	2.	13	14	15	16	17	18	19	20	21
1.	A4			583		356		285	3,539	2.24
2.	A3B1	145		138		114	14	1,984	3,851	2.44
3.	A3C1			27		253		326	606	0.38
4.	A2B2	110	3,858	1,026	21				16,766	10.61
5.	A2B1C1	450	2,536	305	113	9		11	12,348	7.81
6.	A2C2		5,043						5,533	3.50
7.	A2C1E1		1,258						3,983	2.52
8.	A1B3								312	0.20
9.	A1B2C1								3,479	2.20
10.	A1B1C2	1,051	1,904	1,919	514	113	-	182	6,778	4.29
11.	A1B1C1E1	714	532						2,203	1.39
12.	A1B1E2								15	0.01
13.	A1C3	616		262					901	0.57
14.	B4								221	0.14
15.	B3C1				395				3,757	2.38
16.	B2C2	306	1,712	560	531			41	5,303	3.35
17.	B2C1E1		2,348						13,818	8.74
18.	B2E2	316	-						1,446	0.91
19.	B1C3			5,354	2,403	407	31	61	9,147	5.79
20.	B1C2E1	1,136				282	-		2,335	1.48
21.	B1C1E2	2,504					20		2,970	1.88
22.	C4		279	3,967	2,214	856	18	41	7,440	4.71
23.	C3D1			1,098	3,822	973			11,490	7.27
24.	C3E1								635	0.40
25.	C2D2	568		1,261	382	1,297	2,176		7,034	4.45

contd.

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* Data relate to 1968-69.

Appendix 14.4 -Statement V (contd.)

1	2	3	4	5	6	7	8	9	10	11	12
26.	C2D1E1								2,989	2,320	4,704
27.	C1D3										
28.	C1D2E1										
29.	C1D1E2										236
30.	C2E2										
31.	D4							37			
32.	D3E1						2	50	582	722	
33.	D2E2							197	235		2,551
34.	D1E3							95			
35.	E4						11	18.			
	total	2,748	7,109	6,337	11,059	22,040	912	866	5,499	4,908	14,250
	%	1.7	4.5	4.0	7.0	14.0	0.6	0.5	3.5	3.1	9.7

Appendix 14.4 - Statement V (contd.)

1	2	13	14	15	16	17	18	19	20	21
26.	C2D1E1	851					1,410		12,274	7.76
27.	C1D3	446		1,961	1,064	5,633	137		9,241	5.85
28.	C1D2E1				1,101		135		1,236	0.78
29.	C1D1E2	617			279	239	564		1,985	1.26
30.	C2E2						18		18	0.01
31.	D4								37	0.02
32.	D3E1				225				1,581	1.00
33.	D2E2					261	1,188		4,432	2.80
34.	D1E3						719		814	0.51
35.	E4						517		546	0.35
	total	9,830	20,317	18,461	13,064	10,793	6,947	2,931	158,074	
	%	6.2	12.8	11.7	8.3	6.8	4.4	1.9		

Notes. 1. In preparing the Statement, gross cropped areas of the States of Meghalaya, Nagaland, Manipur and the Union Territories were not considered; these total to less than one per cent of the gross cropped area of the country. The total gross cropped areas of the remaining seventeen States is thus, for all practical purposes, taken as all-India gross cropped area and used in computing percentage areas of each of the patterns in terms of all-India.

2. The gross cropped areas shown against each pattern under the various States are based on taluk data except in Bihar, West Bengal and Assam where the unit of area is subdivision, district and police station respectively. Kerala districts are divided into taluks but crop data could be had only for districts. The area under each pattern was calculated on proportionate basis.

Appendix 14.

(Paragraph 14.4.4).

Statement VI All-India Rainfall Patterns

Zone No.	Rainfall Patterns
	A4
001	E4 (A4) C1 E3
002	D1 E3 (A4) C1 D1 E2
003	C1 E3 (A4) D1 E3
004	C1 E3 (A4) C1 D1 E2
005	C1 E3 (A4) B1 C1 E2
006	C1 D1 E2 (A4) C1 D1 E2
007	B1 C1 E2 (A4) C1 E3
008	B2 C1 E1 (A4) C1 E3
009	A1 C1 E2 (A4) C1 E3
010	A1 C1 E2 (A4) A1 B1 E2
011	A1 B1 E2 (A4) C1 E3
012	A1 B1 C1 E1 (A4) C1 E3
013	A2 C1 E1 (A4) C1 E3
014	A2 C1 E1 (A4) B1 E3
	A3 B1
015	E4 (A3 B1) E4
016	E4 (A3 B1) D1 E3
017	D1 E3 (A3 B1) C1 E3
018	D1 E3 (A3 B1) C1 D1 E2
019	C1 E3 (A3 B1) D1 E3
020	B1 E3 (A3 B1) B1 C1 E2
021	B1 C1 E2 (A3 B1) C1 E3
022	B1 C1 E2 (A3 B1) A1 B1 E2
023	B2 E2 (A3 B1) C1 E3

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Appendix 14.4 (contd.)
Statement VI (contd.)

Zone no.	Rainfall Patterns
024	A1 C1 E2 (A3 B1) C1 E3
	A3 C1
025	D1 E3 (A3 C1) C1 E3
026	D1 E3 (A3 C1) C1 D1 E2
027	C1 D1 E2 (A3 C1) C1 D1 E2
028	C1 D1 E2 (A3 C1) B1 C1 E2
	A2 B2
029	E4 (A2 B2) E4
030	E4 (A2 B2) D1 E3
031	D1 E3 (A2 B2) D1 E3
032	D1 E3 (A2 B2) C1 E3
033	D1 E3 (A2 B2) C1 D1 E2
034	C1 E3 (A2 B2) C1 E3
035	C1 D1 E2 (A2 B2) C1 E3
	A2 B1 C1
036	E4 (A2 B1 C1) E4
037	E4 (A2 B1 C1) D1 E3
038	E4 (A2 B1 C1) C1 D1 E2
039	D1 E3 (A2 B1 C1) D1 E3
040	D2 E2 (A2 B1 C1) D2 E2
041	D2 E2 (A2 B1 C1) C1 D1 E2
042	C2 D2 (A2 B1 C1) C2 D1 E1
043	B1 C1 E2 (A2 B1 C1) D1 E3
044	B1 C1 E2 (A2 B1 C1) B1 C1 E2
045	A1 C1 E2 (A2 B1 C1) D1 E3

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Appendix 14.4 (contd.)
Statement VI (contd.)

Zone no.	Rainfall Patterns
	A2 C2
046	E4 (A2 C2) E4
047	E4 (A2 C2) D1 E3
048	D2 E2 (A2 C2) D1 E3
049	D2 E2 (A2 C2) D2 E2
	A2 C1 E1
050	E4 (A2 C1 E1) E4
051	D2 E2 (A2 C1 E1) D1 E3
052	C1 D1 E2 (A2 C1 E1) C1 D1 E2
053	C2 D1 E1 (A2 C1 E1) C1 D1 E2
	A1 B3
054	D1 E3 (A1 B3) C1 E3
055	A1 B1 C1 E1 (A1 B3) C1 D1 E2
	A1 B2 C1
056	E4 (A1 B2 C1) E4
057	E4 (A1 B2 C1) D1 E3
058	D1 E3 (A1 B2 C1) D1 E3
059	C1 D1 E2 (A1 B2 C1) C1 E3
060	B1 C1 E2 (A1 B2 C1) D1 E3
	A1 B1 C1 E1
061	E4 (A1 B1 C1 E1) E4
062	D1 E3 (A1B1 C1 E1) D1 E3
063	D1 E3 (A1 B1 C1 E1) D2 E2

Zone no.	Rainfall Patterns
	A1 B1 C2
064	E4 (A1 B1 C2) E4
065	E4 (A1 B1 C2) D1 E3
066	D1 E3 (A1 B1 C2) D1 E3
067	D1 E3 (A1 B1 C2) C1 E3
068	B1 C1 E2 (A1 B1 C2) B1 C1 E2
069	E4 (A1 B1 C2) C1 D1 E2
	A1 B1 E2
070	E4 (A1 B1 E2) E4
	A1 C3
071	E4 (A1 C3) E4
072	D1 E3 (A1 C3) C1 E3
073	C1 D1 E2 (A1 C3) C1 E3
	E4
074	D1 E3 (E4) C1 E3
075	D2 E2 (E4) C1 D1 E2
	B3 C1
076	E4 (B3 C1) E4
077	E4 (B3 C1) D1 E3
078	D1 E3 (B3 C1) C1 E3
079	D1 E3 (B3 C1) C1 D1 E2

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Zone no.	Rainfall Patterns
080	C1 E3 (B3 C1) D1 E3
081	D2 E2 (B3 C1) C1 D1 E2
	B2 C2
082	E4 (B2 C2) E4
083	E4 (B2 C2) D1 E3
084	D1 E3 (B2 C2) D1 E3
085	C2 D1 E1 (B2 C2) B1 C1 E2
	B2 C1 E1
086	E4 (B2 C1 E1) E4
087	D1 E3 (B2 C1 E1) D1 E3
088	C2 D2 (B2 C1 E1) C1 D1 E2
089	D2 E2 (B2 C1 E1) D2 E2
090	D4 (B2 C1 E1) D1 E3
	B2 E2
091	E4 (B2 E2) E4
092	D2 E2(B2 E2) D1 E3
	B1 C3
093	E4 (B1 C3) E4
094	E4 (B1 C3) D1 E3
095	E4 (B1 C3) C1 D1 E2
096	C1 D2 E1 (E1 C3) C1 E3
097	D2 E2 (B1 C3) C1 D1 E2
098	C1 D1 E2 (B1 C3) B2 E2

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Zone no.	Rainfall Patterns
	B1 C2 E1
099	E4 (B1 C2 E1) E4
100	D1 E3 (B1 C2 E1) C1 E3
101	D2 E2 (B1 C2 E1) D2 E2
102	C1 D3 (B1 C2 E1) C2 D1 E1
103	D3 E1 (B1 C2 E1) C1 D1 E2
	B1 C1 E2
104	E4 (B1 C1 E2) E4
	C4
105	E4 (C4) E4
106	E4 (C4) D1 E3
107	E4 (C4) C1 D1 E2
108	E4 (C4) B1 C1 E2
109	D1 E3 (C4) C1 D1 E2
110	D2 E2 (C4) B2 C1 E1
	C3 D1
111	E4 (C3 D1) E4
112	E4 (C3 D1) D1 E3
113	E4 (C3 D1) C1 D1 E2
114	E4 (C3 D1) C2 E2
115	D1 E3 (C3 D1) C1 E3
	C3 E1
116	E4 (C3 E1) E4

Zone no.	Rainfall Patterns
	C2 D2
117	E4 (C2 D2) E4
118	E4 (C2 D2) D1 E3
119	E4 (C2 D2) D2 E2
120	E4 (C2 D2) C2 E2
121	E4 (C2 D2) B2 C1 E1
122	D1 E3 (C2 D2) C1 E3
123	D1 E3 (C2 D2) C1 D1 E2
124	D1 E3 (C2 D2) C2 D1 E1
125	D2 E2 (C2 D2) C2 D1 E1
126	C1 E3 (C2 D2) C1 D1 E2
127	C2 D2 (C2 D2) C1 D1 E2
128	D2 E2 (C2 D2) D2 E2
129	C2 D2 (C2 D2) C1 E3
	C2 D1 E1
130	E4 (C2 D1 E1) E4
131	E4 (C2 D1 E1) A1 B1 C1 E1
132	D1 E3 (C2 D1 E1) C2 D1 E1
133	D1 E3 (C2 D1 E1) B1 C1 E2
134	D1 E3 (C2 D1 E1) B1 C2 E1
	C1 D3
135	E4 (C1 D3) E4
136	E4 (C1 D3) D1 E3
137	E4 (C1 D3) D2 E2
138	E4 (C1 D3) C2 E2

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Zone no.	Rainfall Patterns
139	E4 (C1 D3) A1 B1 C1 E1
140	C1 E3 (C1 D3) C1 D1 E2
141	D1 E3 (C1 D3) C2 E2
142	D1 E3 (C1 D3)D1 E3
143	D1 E3 (C1 D3)C1 D1 E2
144	C1 D1 E2 (C1 D3)C1 D1 E2
	C1 D2 E1
145	E4 (C1 D2 C1) C2 E2
146	E4 (C1 D2 E1) B1 C1 E2
147	E4 (C1 D2 E1) B2 E2
148	D1 E3 (C1 D2 E1) C1 D1 E2
	C1 D1 E2
149	E4 (C1 D1 E2) E4
150	D1 E3 (C1 D1 E2) D1 E3
151	C1 E3 (C1 D1 E2) C1 D1 E2
152	D1 E3 (C1 D1 E2) C2 D1 E1
153	D1 E3 (C1 D1 E2) A1 B1 C1 E1
	D4
154	C3 D1 (D4) C1 D1 E2
	D3 E1
155	E4 (D3 E1)E4
156	E4 (D3 E1) B2 C1 E1
157	C3 D1 (D3 E1) C1 D1 E2
158	C1 D3 (D3 E1) C1 D1 E2

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Appendix 14.4 (contd.)

Statement VI (contd.)

Zone no.	Rainfall patterns
	D2 E2
159	E4 (D2 E2) E4
160	E4 (D2 E2) A1 B2 E1
161	D1 E3 (D2 E2) C2 D1 E1
162	D2 E2 (D2 E2) C2 D1 E1
163	D4 (D2 E2) D1 E3
164	C1 D1 E2 (D2 E2) C1 D1 E2
165	D2 E2 (D2 E2) C2 E2
166	D1 E3 (D2 E2) C1 D1 E2
	D1 E3
167	D2 E2 (D1 E3) C2 D1 E1
168	C3 D1 (D1 E3) C1 D1 E2
	E4
169	E4 (E4) E4
170	E4 (E4) C2 D1 E1
171	D1 E3 (E4) C2 E2
172	D1 E3 (E4) B1 C2 E1
173	D4 (E4) D1 E3
174	D4 (E4) C1 D1 E2

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Note: Rainfall patterns above have been listed according to decreasing order of the rainfall patterns of the southwest monsoon months of June to September (A4 to E4).

type - SW monsoon	no. of all-India patterns
A	73
B	31
C	49
D	15
E	6

APPENDIX 14.5

(Paragraph 14.5.3)

Statement I- Rainfall Regions - Geographical (reporting) and Gross Cropped Areas

Region no.	Rainfall pattern	Geographical area (sq km)	% to all-India	Gross cropped area (thousand ha)	% to all-India
1.	E4 (E4) E4	135309	5.05	4311	2.73
2.	E4 (C1 E3) E4	133343	4.98	7971	5.04
3.	E4 (C2 E2) E4	186613	6.96	14127	8.94
4.	E4 (C4/C3) E4	365350	13.63	26707	16.90
5.	E4 (B1 C1 E2)E4	54415	2.03	2950	1.87
6.	E4 (B2 E2)E4	28980	1.08	1461	0.92
7.	E4 (B2 C1 E1)E4	194729	7.27	13789	8.72
8.	E4 (B2 C2) E4	79041	2.95	5262	3.33
9.	E4 (B4/B3) E4	45358	1.69	4007	2.54
10.	E4 (A1 C1) E4	9844	0.37	616	0.39
11.	E4 (A1 B1 C1 E1) E4	36605	1.37	2203	1.39
12.	E4 (A1 B1 C2)E4	104859	3.91	6440	4.07
13.	E4 (A2 C1 E1) E4	68742	2.56	3862	2.44
14.	E4 (A2 C2) E4	94543	3.53	5533	3.50
15.	E4 (A2 B1 C1) E4	193448	7.22	11965	7.57
16.	E4 (A2 B2) E4	254641	9.50	11302	7.15
17.	E4 (A3 B1) E4	9692	0.36	283	0.18
	Total (1-17)	1995512	74.48	122789	77.68

Appendix 14.5 (contd)

Statement - I (contd)

Region no.	Rainfall pattern	Geographical area (sq km)	% to all-India	Gross cropped area (thousand ha)	% to all-India
18.	E4 (E4) C1 E3	3833	0.14	139	0.09
19.	E4 (E4) C2 E2	39189	1.46	2105	1.33
20.	E4 (E4) B1 C2 E1	5662	0 .21	192	0.12
21.	E4 (E4) B2 C1 E1	6804	0.25	225	0.14
22.	E4 (E4)A1 B2 E1	1907	0.07	127	0.08
23.	E4 (C1 E3) C1 E3	35324	1.32	1551	0.98
24.	E4 (C1 E3) C2 E2	34939	1.30	1469	0.93
25.	E4 (C1 E3) B2 E2	4724	0.18	157	0.10
26.	E4 (C1 E3) A1 B1 C1 E1	5551	0.21	262	0.17
27.	E4 (C2 E2) C2 E2	60320	2.25	2947	1.37
28.	E4 (C2 E2) B1 C2 E1	16745	0.62	1061	0.67
29.	E4 (C2 E2) A1 B1 C1 E1	4458	0.17	321	0.20
30.	E4 (C4/C3) C1 E3	62037	2.31	4110	2.60
31.	E4 (B3 C1) C1 E3	35159	1.31	1380	0.88
32.	E4 (A1 C3) C1 E3	5622	0.21	262	0.17
33.	E4 (A1 B1 C2)C1 E3	6090	0.23	156	0.10
34.	E4 (A2 B1 C1)C1 E3	3063	0.11	80	0.05
35.	E4 (A2 B2) C1 E3	23203	0.87	1395	0.89
36.	E4 (A4/A3)C1 E3	52,623	1.96	1118	0.71
37.	C1 E3 (A4/A3) E4	4600	0.17	413	0.26

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Appendix 14.5 (contd)

Statement - I (contd)

Region no.	Rainfall pattern	Geographical area (sq km)	% to all-India	Gross cropped area (thousand ha)	% to all-India
38.	C1 E3 (E4) C1 E3	2665	0.10	129	0.08
39.	C1 E3 (C1 E3) C1 E3	21933	0.82	1030	0.65
40.	C1 E3 (C2 E2) C1 E3	12908	0.48	795	0.50
41.	C1 E3 (B1 C3) C1 E3	795	0.03	44	0.03
42.	C1 E3 (A1 B2 C1) C1 E3	679	0.03	33	0.02
43.	C1 E3 (A2 C1 E1) C1 E3	3256	0.12	70	0.04
44.	C1 E3 (A2 B2) C1 E3	55076	2.06	4092	2.59
45.	C1 E3 (A4/A3) C1 E3	9742	0.36	359	0.23
46.	C1 E3 (B1 C2 E1) C2 E2	2845	0.11	35	0.02
47.	C1 E3 (B1 C3) B2 E2	571	0.02	61	0.04
48.	C1 E3 (B3 C1) E4	20845	0.78	2167	1.37
49.	C1 E3 (A4/A3) B1 C1 E2	8660	0.32	431	0.27
50.	C2 E2 (C2 E2) C1 E3	7070	0.26	75	0.05
51.	C2 E2 (B2 C1 E1) C1 E3	1143	0.04	29	0.02
52.	C2 E2 (A2 C1 E1) C1 E3	2484	0.09	51	0.03
53.	C2 E2 (A2 B1 C1) C2 E2	3105	0.12	110	0.07
54.	C3 E1 (E4) C1 E3	4278	0.16	182	0.12
55.	B1 E3 (A3 B1) B1 C1 E2	16887	0.63	1221	0.77
56.	B1 C1 E2 (A1 B1 C2) B1 C1 E2	2207	0.08	193	0.12
57.	B1 C1 E2 (A2 B1 C1) E4	6073	0.23	321	0.20
58.	B1 C1 E2 (A4/A3) A1 B1 E2	13326	0.50	1048	0.66
59.	B1 C1 E2(A4/A3) C1 E3	24653	0.92	938	0.59
		221,201	8.26	13419	8.47

Appendix 14.5 (contd)

Statement – I (contd)

Region no.	Rainfall pattern	Geographical area (sq km)	% to all-India	Gross cropped area (thousand ha)	% to all-India
60.	A1 C1 E2 (A4/A3) C1 E3	34665	1.29	1806	1.14
61.	A1 B1 C1 E1 (A1 B3) C1 E3	1879	0.07	38	0.02
62.	A2 C1 E1 (A4) C1 E3	10547	0.39	365	0.23
	total (18-62)	680145	25.37	35098	22.20
Special	(two zones of Kerala and five of Tamil Nadu)	4857	0.18	187	0.12
All-India		2680514	100	158074	100

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(Paragraph 14.5.3)

Statement II - Number of Taluks under each of the Rainfall Regions

Region	rainfall pattern and calendar month equivalents	states	number of districts	number of taluks
1.	E4 (E4) E4	Rajasthan	6	23
		Haryana	1	3
	all months with less than 10 cm pm.	Punjab	2	3
		Himachal Pradesh	2	3
		Jammu & Kashmir	3	13
2.	E4 (C1 E3) E4	Rajasthan	1	2
	Jl C1	Gujarat	4	19
	S C1	Maharashtra	5	20
		Andhra Pradesh	3	9
		Karnataka	6	37
3.	E4 (C2 [illegible]) E4	Himachal Pradesh	1	2
	Jl C2/Au C2/Jn C1 SC1	Punjab	8	22
		Haryana	5	13
		Rajasthan	15	61
		Gujarat	5	20
		Maharashtra	6	16
		Andhra Pradesh	1	3
4.	E4 (C4 / C3) E4	Himachal Pradesh	1	3
	Jn (C4 / C3)	Punjab	3	8
		Haryana	4	12
		Rajasthan	4	20
		Uttar Pradesh	10	34
		Madhya Pradesh	3	11
		Gujarat	6	17
		Maharashtra	17	111
		Karnataka	3	19
		Andhra Pradesh	21	60
5.	E4 (B1 C1 B2) E4	Rajasthan	3	14
	Jl B1 C1	Gujarat	8	42
6.	E4 (B2 B2) E4	Gujarat	2	4
	Jl B2	Rajasthan	8	22
		Jammu & Kashmir	1	1

Appendix 14.5 (contd)
Statement II (contd)

region	rainfall pattern	state	number of districts	number of taluks
7.	E4 (B2 C1 E1) E4 J1 B2 C1	Jammu & Kashmir	1	1
		Himachal Pradesh	2	4
		Punjab	3	8
		Haryana	1	4
		Rajasthan	9	37
		Uttar Pradesh	29	86
		Madhya Pradesh	8	31
8.	E4 (B2 C2) E4 Jn C1 B2 C1	Bihar	4	6
		Uttar Pradesh	4	8
		Madhya Pradesh	6	21
		Gujarat	2	6
		Maharashtra	2	6
		Andhra Pradesh	4	8
9.	E4 (B4 / B3) E4 Jn (B4 / B3)	Uttar Pradesh	9	20
		Bihar	6	11
		Andhra Pradesh	1	5
10.	E4 (A1 C3) E4 Jn C1 A1 C2	Gujarat	3	16
11.	E4 (A1 B1 C1 E1) E4 J1 A1 B1 C1	Uttar Pradesh	2	6
		Madhya Pradesh	3	6
		Gujarat	2	14
		Rajasthan	1	4
		Himachal Pradesh	4	8
12.	E4 (A1 B1 C2) E4 Jn C1 A1 B1 C1	Bihar	3	3
		Uttar Pradesh	3	7
		Madhya Pradesh	7	15
		Gujarat	5	23
		Maharashtra	7	17
		Andhra Pradesh	2	8

Statement II (contd)

region	rainfall pattern	state	number of districts	number of taluks	
13.	E4 (A2 C1 B1) E4 Jn A2 C1	Jammu & Kashmir	2	7	
		Himachal Pradesh	1	4	
		Punjab	1	1	
		Rajasthan	4	13	
		Uttar Pradesh	4	12	
		Madhya Pradesh	5	13	
14.	E4 (A2 C2) E4 Jn C1 A2 C1	Madhya Pradesh	16	46	
		Uttar Pradesh	3	4	
		Himachal Pradesh	3	6	
15.	E4 (A2 B1 C1) E4 Jn C1 A2 B1	Himachal Pradesh	1	2	
		Uttar Pradesh	12	21	
		Bihar	10	19	
		West Bengal	2 (full)	-	
		Madhya Pradesh	9	19	
		Gujarat	3	15	
		Maharashtra	6	13	
		Andhra Pradesh	1	2	
16.	E4 (A2 B2) E4 Jn B1 A2 B1	Bihar	7	16	
		Orissa	8	21	
		Madhya Pradesh	7	23	
		Gujarat	1	4	93
		Maharashtra	3	3	
		Andhra Pradesh	1	1	
17.	E4 (A3 B1) E4 Jn A3 B1	Gujarat	2	5	
		Maharashtra	2	7	12

Appendix 14.5 (contd)

Statement II (contd)

region	rainfall pattern	state	number of districts	number of taluks
18.	E4 (E4) C1 E3 O C1	Karnataka	1	2
		Himachal Pradesh	1	4
19.	E4 (E4) C2 E2 O C2	Tamil Nadu	5	29
20.	E4 (E4) B1 C2 E1 O C1	Tamil Nadu	2	5
21.	E4 (E4) B2 C1 E1 O B2 C1	Andhra Pradesh	1	5
22.	E4 (E4) A1 B2 E1 O B1 A1 B1	Tamil Nadu	1	2
23.	E4 (C1 E3) C1 E3 S C2	Andhra Pradesh	1	6
		Karnataka	7	26
24.	E4 (C1 E3) C2 E2 S C3	Tamil Nadu	3	8
		Andhra Pradesh	4	13
25.	E4 (C1 E3) B2 E2 S C1 B2	Andhra Pradesh	1	3
26.	E4 (C1 E3) A1 B1 C1 E1 S C1 B1 A1 C1	Tamil Nadu	1	2
		Andhra Pradesh	2	3
27.	E4 (C2 E2) C2 E2 Au C4	Tamil Nadu	9	30
		Andhra Pradesh	2	7
		Karnataka	5	24
28.	E4 (C2 E2) B1 C2 E1 Au C3 B1 C1	Tamil Nadu	5	17
29.	E4 (C2 E2) A1 B1 C1 E1 Au C2 B1 A1 C1	Tamil Nadu	3	5
30.	E4 (C4/C3) C1 E3 Jn (C4/C3) O C1	Karnataka	4	14
		Andhra Pradesh	7	57
		Orissa	1	1
		Himachal Pradesh	1	2

Appendix 14.5 (contd)

Statement II (contd)

region	rainfall pattern	state	number of districts	number of taluks
31.	E4 (B4/B3) C1 E3 Jn (B4/B3) 0 C1	Orissa	6	25
		Andhra Pradesh	2	4
32.	E4 (A1 C3) C1 E3 Jn C1 A1 C3	Maharashtra	4	12
33.	E4 (A1 B1 C2) C1 E3 Jn C1 A1 B1 C2	Andhra Pradesh	1	1
		Karnataka	3	4
34.	E4 (A2 B1 C1) C1 E3 Jn C1 A2 B1 C1	Karnataka	1	1
		Himachal Pradesh	1	6
35.	E4 (A2 B2) C1 E3 Jn B1 A2 B1 C1	Orissa	6	24
36.	E4 (A4/A3) C1 E3 Jn (A4/A3) 0 C1	Karnataka	4	20
		Maharashtra	5	41
		Orissa	1	3
37.	C1 E3 (A4/A3) E4 My C1 Jn (A4/A3)	Bihar	1	2
38.	C1 E3 (E4) C1 E3 My C1 – 0 C1	Karnataka	1	2
		Himachal Pradesh	1	1
39.	C1 E3 (C1 E3) C1 E3 My C1 – S C2	Tamil Nadu	1	2
		Karnataka	4	21
40.	C1 E3 (C2 E2) C1 E3 My C1 – Au C3	Tamil Nadu	2	9
		Karnataka	1	6
41.	C1 E3 (B1 C3) C1 E3 My C2 B1 C3	Assam	1	2

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Appendix 14.5 (contd)
Statement II (contd)

region	rainfall pattern	state	number of districts	number of taluks
42.	C1 E3 (A1 B2 C1) C1 E3 My C1 B1 A1 B1 C2	Assam	1	2
43.	C1 E3 (A2 C1 E1) C1 E3 Ja C2 - J1 A2 C1	J & K	1	3
44.	C1 E3 (A2 B2) C1 E3 My C1 B1 A2 B1 C1	Assam	2	3
		Bihar	1	1
		West Bengal	6	-
		Orissa	2	9
45.	C1 E3 (A4/A3) C1 E3 My C1 Jn (A4/A3) 0 C1	Karnataka	4	10
46.	C1 E3 (B1 C2 E1) C2 E2 Ja C2 - J1 B1 C3	Himachal Pradesh	1	2
47.	C1 E3 (B1 C3) B2 E2 My C2 B1 C2 B2	Kerala	1	1
48.	C1 E3 (B3 C1) E4 My C1 B3 C1	West Bengal	4	
49.	C1 E3 (A4/A3) B1 C1 E2 My C1 Jn (A4/A3) 0 B1 C1	Karnataka	1	4
		Kerala	2	5
50.	C2 E2 (C2 E2) C1 E3 Ja C3 - J1 C2	Himachal Pradesh	3	3
		Jammu & Kashmir	1	3
51.	C2 E2 (B2 C1 E1) C1 E3 Ja C3 - J1 C1 B2	Jammu & Kashmir	1	2
52.	C2 E2 (A2 C1 E1) C1 E3 Ja C3 - J1 A2 C1	Jammu & Kashmir	2	3

Appendix 14.5 (contd)

Statement II (contd)

region	rainfall pattern	state	number of districts	number of taluks
53.	C2 E2 (A2 B1 C1) C2 E2 Ja C3 - Jn C1 A2 B1 C1	Himachal Pradesh	2	3
54.	C3 E1 (E4) C1 E3 Ja C4	Jammu & Kashmir	3	11
55.	B1 E3 (A3 B1) B1 C1 E2 My B1 A3 B2 C1	Kerala	6	21
56.	B1 C1 E2 (A1 B1 C2) B1 C1 E2 Ap C1 B1 A1 B1 C2 B1 C1	Kerala	2	5
57.	B1 C1 E2 (A2 B1 C1) E4 Ap C1 B1 A2 B1 C1	Assam	3	12
58.	B1 C1 E2 (A4/A3) A1 B1 E2 Ap C1 B1 Jn (A4/A3) 0 A1 B1	Kerala	4	23
59.	B1 C1 E2 (A4/A3) C1 E3 Ap C1 B1 Jn (A4/A3) 0 CI	Assam West Bengal	4 1	35
60.	A1 C1 E2 (A4/A3) C1 E3 Ap C1 B1 Jn (A4/A3) 0 CI	Assam West Bengal	4 2	30
61.	A1 B1 C1 E (A1 B3) C1 E3 Ma C1 B1 A2 B3 C1	Assam	1	1
62.	A2 C1 E1 (A4) C1 E3 Ma C1 A6 C1	Assam	3	15

Appendix 14.5 (contd.)

Statement II (contd.)

Notes:

1. While drawing boundaries of Rainfall Zones (and hence also of Regions) the unit of area is taluk excepting in Assam, West Bengal and Bihar where the unit is police station, district and subdivision respectively. The figures shown in the last column under taluks against Bihar and Assam thus represent subdivision and police station respectively. Against West Bengal the entry is left blank as only full districts are involved.

2. For want of data areas of 99 police stations (against a total of 103) only have been considered in Assam.

3. In taluks in or close to Western Ghats in Maharashtra and Karnataka, rainfall patterns vary in the same taluk and there are two in general. Because of this, a number of them are shown in two different Zones/Regions in parts as (¼, ½ etc.). In Assam, halflong area is shown in two Zones/Regions. Details of these are contained in Appendix 14.6, Statement V. Here, for convenience the fractions of taluks have not been shown; each fractional taluk area has been taken as one for entry in the last column of this Statement.

4. For each rainfall pattern (col 2), all the months with 10 cm pm or higher are shown in calender sequence together with month of commencement e.g. E4(C2 E2)E4 is J-C2 i.e. rainfall is in 10 - 20 cm pm class for two months from July.

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Appendix 14.6

Statement I - Per cent of gross cropped area under Principal Crops, (1969-70 and 1970-71)

(Paragraph 14.6.1)

State/Territory		Paddy	Jowar	Bajra	Maize	Ragi	Wheat	Barley	Small Millets	Gram	Tur
1		2	3	4	5	6	7	8	9	10	11
Andhra Pradesh	1969-70	26.4	19.9	4.5	1.9	2.5	0.1	-	6.4	0.6	1.5
	70-71	26.4	19.2	4.3	1.9	2.2	0.1	-	6.0	0.5	1.5
Assam	1969-70	71.0	-	-	-	-	-	-	0.1	0.1	0.1
Bihar	1969-70	49.3	0.1	0.1	8.5	1.6	10.4	2.6	2.0	2.2	1.5
	70-71	47.8	0.1	0.1	9.0	1.6	11.9	2.3	2.0	2.2	1.4
Gujarat	1969-70	4.7	13.4	20.1	2.6	0.6	4.3	0.1	2.0	0.5	0.9
Haryana	1969-70	4.9	4.7	18.8	2.2	-	20.6	3.0	-	21.9	0.2
	70-71	5.4	4.2	17.9	2.3	-	22.8	2.2	-	21.4	0.2
Himachal Pradesh	1969-70	11.0	-	-	28.2	1.5	35.6	4.7	3.5	1.8	0.1
Jammu & Kashmir	1969-70	27.8	-	1.4	29.5	-	21.1	2.0	1.6	0.2	-
	70-71	25.6	-	2.2	31.2	-	21.2	1.8	1.8	0.2	-
Karnataka	1969-70	10.6	21.2	5.4	0.5	9.3	3.2	-	4.9	1.6	2.9
	70-71	10.6	20.4	5.2	0.6	9.5	3.2	-	5.0	1.5	2.8
Kerala	1969-70	30.0	-	-	-	0.2	-	-	0.2	-	0.3
	70-71	29.8	0.1	-	-	0.2	-	-	0.2	-	0.2

Appendix 14.6 - Statement I (contd.)

Statement I - Per cent of gross cropped area under Principal Crop (1969-70 and 1970-71)

(Paragraph 14.6.1)

State/Territory		Other pulses	Sugar crops	Fruits & Vegetables	Groundnut	Other oil seeds	Cotton	Plantations	Fodder	Gross cropped area (thousand ha)
		12	13	14	15	16	17	18	19	20
Andhra Pradesh	1969-70	9.1	1.2	2.0	10.5	4.9	2.4	0.4	-	13145
	70-71	8.8	0.9	2.0	11.8	5.3	2.4	0.4	-	13347
Assam	1969-70	3.1	1.2	4.5	-	5.3	0.2	7.4	-	2773*
Bihar	1969-70	11.8	1.5	3.6	-	2.2	-	-	-	11063
	70-71	11.2	1.5	3.7	-	2.3	-	-	-	11026
Gujarat	1969-70	5.0	0.5	0.9	16.5	2.1	17.3	-	-	10045*
Haryana	1969-70	1.9	3.4	0.7	0.2	2.5	3.9	-	-	4941
	70-71	1.7	3.1	0.6	0.2	2.7	3.9	-	-	4957
Himachal Pradesh	1969-70	4.8	0.4	4.1	0.2	2.1	0.1	0.4	0.8	911*
Jammu & Kashmir	1969-70	5.0	0.2	2.8	0.1	4.5	0.1	-	3.3	868
	70-71	5.2	0.2	2.8	-	4.6	0.1	-	2.4	866
Karnataka	1969-70	9.0	1.0	1.3	8.9	4.5	9.9	1.0	1.1	10794
	70-71	8.9	0.9	1.4	9.4	4.7	10.5	1.0	1.0	10887
Kerala	1969-70	1.2	0.5		0.4	0.7	0.2	44.5	-	2916
	70-71	1.2	0.5		0.5		0.2	45.1	-	2933

Appendix 14.6 - Statement I (contd.)

1		2	3	4	5	6	7	8	9	10	11
Madhya Pradesh	1969-70	21.3	11.3	1.1	2.8	0.1	16.5	0.9	8.3	7.6	2.4
	70-71	21.2	10.5	1.1	2.8	0.1	16.5	0.8	8.0	7.9	2.4
Maharashtra	1969-70	6.8	28.4	10.9	0.2	1.1	4.3	-	1.0	1.8	3.2
	70-71	7.2	30.0	10.0	0.2	1.2	4.6	-	1.1	1.9	3.3
Manipur	1969-70	92.6	-	-	2.7	-	-	-	-	-	-
	70-71	92.6	-	-	2.7	-	-	-	-	-	-
Meghalaya	1969-70	50.3	-	-	7.7	-	-	-	1.0	-	-
Nagaland	1969-70	58.8	-	-	8.8	-	-	-	20.6	-	-
	70-71	58.8	-	-	8.8	-	-	-	20.6	-	-
Orissa	1969-70	53.8	0.2	-	0.9	1.9	0.2	-	2.0	0.3	0.4
	70-71	53.4	0.2	-	0.9	1.8	0.2	-	1.9	0.3	0.6
Punjab	1969-70	6.5	0.1	3.9	9.7	-	39.4	1.3	-	6.9	0.1
	70-71	6.7	0.1	3.6	9.8	-	40.5	1.0	-	6.3	0.1
Rajasthan	1969-70	0.8	8.0	30.3	5.5	-	8.7	3.3	0.5	8.9	0.2
	70-71	0.7	31.0	30.7	4.5		8.8	3.1	0.4	9.7	0.1
Tamil Nadu	1969-70	35.2	10.9	6.7	0.2	4.3	-	-	6.8	-	0.7
	70-71	35.7	10.1	6.4	0.2	3.8	-	-	6.3	-	0.9
Tripura	1969-70	77.8	-	-	-	-	-	-	-	-	-
	70-71	77.7	-	-	-	-	-	-	-	-	-
Uttar Pradesh	1969-70	19.0	3.2	4.4	6.5	1.1	23.7	0.4	2.8	9.8	2.5
	70-71	19.0	3.2	4.8	6.5	1.1	25.5	0.7	2.6	9.0	2.5

Appendix 14.6 - Statement I (contd.)

		12	13	14	15	16	17	18	19	20
Madhya Pradesh	1969-70	9.8	0.3	0.6	2.0	6.8	3.3	-	3.9	20298
	70-71	10.4	0.3	0.6	2.3	7.0	3.3	-	3.8	20562
Maharashtra	1969-70	9.2	1.1	1.1	4.6	4.2	14.4	1.0	5.7	19435
	70-71	9.7	1.1	1.1	4.9	4.4	14.6	1.0	5.4	19304
Manipur	1969-70	-	0.5	-	-	1.1	-	-	-	188
	70-71	-	0.5	-	-	1.1	-	-	-	188
Meghalaya	1969-70	6.5	-	22.5	-	2.6	4.6	3.0	-	195*
Nagaland	1969-70	2.9	1.0	3.9	-	2.0	1.0	-	-	102
	70-71	2.9	1.0	3.9	-	2.0	1.0	-	-	102
Orissa	1969-70	9.0	0.5	4.9	0.8	3.8	-	0.1	0.5	8382
	70-71	9.1	0.4	5.9	0.8	3.2	-	0.3	0.5	8440
Punjab	1969-70	0.9	2.7	1.1	3.4	1.9	7.4	-	13.9	5499
	70-71	0.9	2.3	1.0	3.1	2.0	7.0	-	14.7	5678
Rajasthan	1969-70	13.6	0.4	0.3	1.4	5.0	1.6	-	10.7	14267
	70-71	11.8	0.2	0.2	1.3	5.2	1.3	-	13.6	16729
Tamil Nadu	1969-70	5.2	2.2	3.3	12.5	2.9	3.9	2.8	0.8	7161
	70-71	5.8	1.8	3.2	13.3	3.1	4.0	2.8	1.1	7384
Tripura	1969-70	0.9	0.9	10.5	0.3	1.7	0.9	0.2	-	343
	70-71	0.9	0.9	10.1	0.3	1.7	0.6	0.2	-	345
Uttar Pradesh	1969-70	5.4	6.0	1.7	1.5	1.4	0.2	-	3.3	22968
	70-71	5.1	5.8	1.7	1.5	1.6	0.2	-	3.3	23207

Appendix 14.6 - Statement I (contd.)

1		2	3	4	5	6	7	8	9	10	11
West Bengal	1969-70	71.2	-	-	0.7	0.1	2.9	0.9	0.2	2.3	0.6
	70-71	69.9	-	-	0.7	0.1	5.1	0.9	0.2	2.2	0.4
Andaman & Nicobar Islands	1969-70	44.4	-	-	-	-	-	-	-	-	-
	70-71	44.4	-	-	-	-	-	-	-	-	-
Arunachal Pradesh	1969-70	100.0	-	-	-	-	-	-	-	-	-
	70-71	100.0	-	-	-	-	-	-	-	-	-
Dadra and Nagar Haveli	1969-70	52.9	5.9	-	-	11.8	-	5.9	-	-	5.9
	70-71	52.9	5.9	-	-	17.6	-	5.9	-	-	5.9
Delhi	1969-70	2.7	7.2	18.9	0.9	-	40.5	2.0	1.8	5.4	-
	70-71	1.7	9.4	20.5	0.9	-	39.3	2.8	-	8.5	-
Goa, Daman and Diu	1969-70	37.4	-	-	-	-	-	-	10.7	-	-
	70-71	37.4	-	-	-	-	-	-	10.7	-	-
Lakshadweep	1969-70	-	-	-	-	-	-	-	-	-	-
	70-71	-	-	-	-	-	-	-	-	-	-
Mizoram	1969-70	80.0	-	2.5	-	-	-	-	-	-	-
	70-71	80.0	-	2.5	-	-	-	-	-	-	-
Pondicherry	1969-70	58.8	-	3.9	5.9	-	-	-	-	-	-
	70-71	66.8	-	3.9	3.9	-	-	-	-	-	-
All-India	1969-70	22.8	10.4	7.7	3.5	1.6	10.2	1.7	3.2	4.7	1.6
	70-71	22.3	10.7	7.9	3.5	1.5	10.8	1.5	3.0	4.7	1.6

Appendix 14.6 - Statement I (contd.)

		12	13	14	15	16	17	18	19	20
West Bengal	1969-70	7.0	0.6	2.2	-	2.3	-	1.2	-	7054
	70-71	6.8	0.6	2.3	-	2.4	-	1.2	-	7092
Andaman & Nicobar Islands	1969-70	-	-	5.6	-	-	-	50.0	-	18
	70-71	-	-	5.6	-	-	-	50.0	-	18
Arunachal Pradesh	1969-70	-	-	-	-	-	-	-	-	55
	70-71	-	-	-	-	-	-	-	-	56
Dadra and Nagar Haveli	1969-70	17.6	-	-	-	-	-	-	-	17
	70-71	17.6	-	-	-	-	-	-	-	17
Delhi	1969-70	2.7	-	4.5	-	0.9	-	9.0	-	111
	70-71	2.6	-	4.3	-	0.9	-	8.5	-	117
Goa, Daman and Diu	1969-70	-	-	29.5	-	12.5	-	38.1	-	139
	70-71	-	-	28.8	-	13.7	-	38.1	-	139
Lakshadweep	1969-70	-	-	-	-	-	-	100.0	-	3
	70-71	-	-	-	-	-	-	100.0	-	3
Mizoram	1969-70	-	2.5	10.0	-	-	2.5	-	-	40
	70-71	-	2.5	10.0	-	-	2.5	-	-	40
Pondicherry	1969-70	9.8	2.9	2.9	5.9	3.9	-	4.0	-	51
	70-71	5.9	2.9	2.9	7.8	5.9	-	6.0	-	51
All-India	1969-70	7.7	1.7	2.1	4.3	4.1	4.8	1.4	4.1	163782
	70-71	7.5	1.6	2.1	4.5	4.2	4.7	1.4	4.4	167412

Details under plantations are shown in accompanying Table.

*Figures in 1969-70 repeated in 1970-71 to arrive at the all-India total.

Appendix 14.6 - Statement I (contd.)

Percent of gross cropped area under plantation crops (1969-70 and 1970-71)

		Pepper	Carda-mom	Betel-nut	Cashew-nut	coco-nut	coffee	tea	rubber	total plantations
Andhra Pradesh	1969-70	-	-	-	0.2	0.3	-	-	-	0.5
	1970-71	-	-	-	0.2	0.3	-	-	-	0.5
Assam	1969-70	-	-	0.3	-	0.1	-	6.5	-	7.4
Himachal Pradesh	1969-70	-	-	-	-	-	-	0.4	-	0.4
Kerala	1969-70	4.0	1.6	2.9	3.4	24.3	1.0	1.2	6.0	44.5
	1970-71	4.0	1.6	2.9	3.5	24.5	1.1	1.2	6.1	44.1
Maharashtra	1969-70	-	-	-	0.1	-	-	-	-	1.0
	1970-71	-	-	-	0.1	0.1	-	-	-	1.1
Meghalaya	1969-70	-	-	3.0	-	-	-	-	-	3.0
	1970-71	-	-	3.0	-	-	-	-	-	3.0
Karnataka	1969-70	-	0.2	0.4	0.2	1.2	1.0	-	-	3.1
	1970-71	-	0.2	0.4	0.2	1.2	1.0	-	0.1	3.1
Orissa	1969-70	-	-	-	-	0.1	-	-	-	0.1
	1970-71	-	-	-	0.2	0.1	-	-	-	0.3
Tamil Nadu	1969-70	-	0.1	-	0.7	1.1	0.3	0.5	0.1	2.8
	1970-71	-	0.1	-	0.7	1.2	0.3	0.5	0.1	2.3

Appendix 14.6 Statement I (Contd)

		Pepper	Carda-mom.	Betel-nut	Cashew-nut	coco-nut	coffee	tea	rubber	total plantations
Tripura	1969-70	-	-	-	-	-	-	0.2	-	0.2
	1970-71	-	-	-	-	-	-	0.2	-	0.2
West Bengal	1969-70	-	-	-	-	0.1	-	1.1	-	1.2
	1970-71	-	-	-	-	0.1	-	1.1	-	1.2
Andaman & Nicobar Islands	1969-70	-	-	-	-	50.0	-	-	-	50.0
	1970-71	-	-	-	-	50.0	-	-	-	50.0
Goa, Daman and Diu	1969-70	-	-	1.4	23.7	12.9	-	-	-	38.1
	1970-71	-	-	1.4	23.0	13.7	-	-	-	38.1
Lakshadweep	1969-70	-	-	-	-	100.0	-	-	-	100.0
	1970-71	-	-	-	-	100.0	-	-	-	100.0
Pondicherry	1969-70	-	-	-	2.0	2.0	-	-	-	4.0
	1970-71	-	-	-	2.0	4.0	-	-	-	6.0
All India	1969-70	0.1	-	0.1	0.1	0.6	0.1	0.2	0.1	1.4
	1970-71	0.1	-	0.1	0.1	0.6	0.1	0.2	0.1	1.4

APPENDIX 14.6

(Paragraph 14.6.1)

Statement II - Relative Yield Index (RYI) values of Principal Crops[(a)]

States Union Territories	Rice	Wheat	Jowar	Bajra	Maize
Jammu & Kashmir	141	80	198	115	91
Himachal Pradesh	103	70	79	-	161
Punjab	141	181	155	239	138
Chandigarh	-	-	-	-	-
Haryana	125	162	42	128	98
Delhi	108	143	73	220	57
Rajasthan	73	92	71	61	74
Uttar Pradesh	70	100	118	149	89
Madhya Pradesh	72	57	124	118	71
Bihar	71	73	90	111	90
Orissa	85	102	139	156	77
West Bengal	110	170	124	109	84
Arunachal Pradesh	76	-	-	-	-
Assam (b)	92	49	-	-	50
Nagaland	80	-	-	-	-
Manipur	131	-	-	-	197
Tripura	79	-	-	-	-
Gujarat	79	116	60	147	97
Maharashtra	99	40	89	77	71
Dadra & Nagar Haveli	109	-	-	-	-
Karnataka	163	30	137	88	262
Goa, Daman & Diu	121	-	-	-	-
Andhra Pradesh	118	19	89	104	111
Kerala	132	-	85	-	-
Andaman & Nicobar Islands	115	-	-	-	-
Tamil Nadu	159	27	146	143	100
Lakhshadweep	-	-	-	-	-
Pondicherry	181	-	-	259	-
All-India average yield (tonnes/ha)	1.094	1.228	0.506	0.457	1.079

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contd. ....

Appendix 14.6 – Statement II (contd)

States/Union Territories	Small millets	Ragi	Barley	Tur	Gram
Jammu & Kashmir	176	-	53	-	36
Himachal Pradesh	226	92	121	71	89
Punjab	194	-	101	92	128
Chandigarh	-	-	-	-	-
Haryana	258	-	121	61	131
Delhi	-	-	82	-	93
Rajasthan	77	-	126	57	96
Uttar Pradesh	163	94	94	163	115
Madhya Pradesh	62	34	90	94	78
Bihar	116	71	70	107	99
Orissa	105	110	-	80	88
West Bengal	157	101	76	108	115
Arunachal Pradesh	-	-	-	-	-
Assam (b)	119	-	-	99	75
Nagaland	-	-	-	-	-
Manipur	-	-	-	-	-
Tripura	-	-	-	57	-
Gujarat	188	91	38	67	91
Maharashtra	104	97	66	68	44
Dadra & Nagar Haveli	-	100	-	59	-
Karnataka	67	99	68	71	61
Goa, Daman & Diu	-	-	-	-	-
Andhra Pradesh	56	92	-	50	39
Kerala	137	164	-	57	-
Andaman & Nicobar Islands	-	-	-	-	-
Tamil Nadu	199	126	-	57	81
Lakshadweep	-	-	-	-	-
Pondicherry	-	191	-	-	-
All-India average yield (tonnes/ha)	0.378	0.790	0.986	0.701	0.666

contd. ....

States/Union Territories	Other pulses	Ground-nut	Sesa-mum	Line-seed	Castor seed
Jammu & Kashmir	169	407	122	320	-
Himachal Pradesh	88	136	119	90	-
Punjab	128	124	188	219	-
Chandigarh	-	-	-	-	-
Haryana	105	99	167	212	-
Delhi	94	-	-	-	-
Rajasthan	52	58	54	131	136
Uttar Pradesh	212	96	86	97	230
Madhya Pradesh	83	85	83	91	110
Bihar	158	91	149	255	152
Orissa	133	160	234	154	219
West Bengal	159	-	281	115	-
Arunachal Pradesh	-	-	-	-	-
Assam (b)	94	-	243	188	148
Nagaland	-	-	-	-	-
Manipur	-	-	-	-	-
Tripura	92	-	202	-	-
Gujarat	65	96	147	-	175
Maharashtra	74	91	107	81	52
Dadra & Nagar Haveli	-	-	-	-	-
Karnataka	73	92	130	100	168
Goa, Daman & Diu	-	-	-	-	-
Andhra Pradesh	53	103	101	68	70
Kerala	98	197	164	-	-
Andaman & Nicobar Islands	-	-	-	-	-
Tamil Nadu	57	126	159	-	139
Lakshadweep	-	-	-	-	-
Pondicherry	-	167	167	-	-
All-India average yield (tonnes/ha)	0.378	0.736	0.200	0.235	0.303

contd. .....

Appendix 14.6. Statement II (contd)

States/Union Territories	Rape & mustared	Saf-flower	Niger	Potato	Sugar-cane
Jammu & Kashmir	144	-	-	45	23*
Himachal Pradesh	64	-	-	55	23
Punjab	104	-	-	140	76*
Chandigarh	-	-	-	-	-
Haryana	121	-	-	170	89*
Delhi	-	-	-	61	10
Rajasthan	133	-	-	28	38*
Uttar Pradesh	103	-	-	106	84*
Madhya Pradesh	61	112	76	124	51
Bihar	103	142	148	113	79*
Orissa	80	-	180	129	107*
West Bengal	61	-	-	94	100
Arunachal Pradesh	-	-	76	-	-
Assam (b)	73	-	-	55	84*
Nagaland	-	-	-	-	-
Manipur	-	-	-	-	-
Tripura	77	-	-	76	71
Gujarat	83	-	-	262	100*
Maharashtra	40	109	-	50	149*
Dadra & Nagar Haveli	-	-	-	-	-
Karnataka	55	78	61	50	175*
Goa, Daman & Diu	-	-	-	-	146
Andhra Pradesh	64	94	123	42	153*
Kerala	-	-	-	-	118*
Andaman & Nicobar Islands	-	-	-	-	-
Tamil Nadu	38	-	-	93	169*
Lakshadweep	-	-	-	-	-
Pondicherry	-	-	-	-	196
All-India average yield (tonnes/ha)	0.520	0.223	0.223	8.661	5.014

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States/Union Territories	Tobacco	Jute	Cotton	Mesta	Sunn-hemp
Jammu & Kashmir	167	-	359	-	[illegible]
Himachal Pradesh	47	-	198	-	69
Punjab	125	-	305	-	69
Chandigarh	-	-	-	-	-
Haryana	89	-	263	-	55
Delhi	125	-	154	*	
Rajasthan	93	-	111	23	80
Uttar Pradesh	108	117	131	-	106
Madhya Pradesh	65	-	65	46	91
Bihar	121	75	214	119	129
Orissa	102	104	256	138	192
West Bengal	105	101	-	157	212
Arunachal Pradesh	-	-	-	-	-
Assam (b)	94	118	62	107	
Nagaland	-	-	-	-	-
Manipur	-	-	-	-	-
Tripura	39	116	138	178	-
Gujarat	148	-	144	-	161
Maharashtra	53	-	56	49	75
Dadra & Nagar Haveli	-	-	-	-	
Karnataka	61	-	53	53	56
Goa, Daman & Diu	-	-	-	-	-
Andhra Pradesh	84	-	45	92	120
Kerala	207	-	92	-	-
Andaman & Nicobar Islands	-	-	-	-	
Tamil Nadu	183	-	164	129	
Lakshadweep	-	-	-	-	
Pondicherry	-	-	308	-	
All-India average yield (tonnes/ha)	0.795	1.187	0.117	0.638	0.402

(a) Relative yield index-(RYI) is the State yield expressed as percentage of all-India and is based on data for the triennium ending 1970-71 as published in the Estimates of Area and production of Principal Crops in India, 1971-72, Directorate of Economics and Statistics, Ministry of Agriculture & Irrigation, Government of India.

(b) Includes Meghalaya & Mizoram.

Appendix 14.6

(Paragraph 14.6.2)

Statement III - Cropping Patterns - Statewise

Notes:-

1. Cropping patterns of taluks with some dominant and some common crops but differing generally in one or two crops are grouped together and the differing crops shown as alternates by oblique lines e.g. $Pd_3R_4Pu_4/Jk_4$.
2. In a few cases taluk patterns have been shown under 'special' as they do not fit in with neighbourhood.

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Andhra Pradesh

1. Pd1
2. Pd2 Pu4/R4/Jr4/Gn4/B4/M4/S4/Fb4
3. Pd3 R4 G4
4. Pd3 Gn4 Fb4/Pu4
5. Pd3 Pu4 B4 G4
6. Pd3 Pu4 Fr4 G4 /S4/To5
7. Pd3 Fr4 G4
8. Pd3 Pu4 Gn4 Jr4/Fr4
9. Pd3 Jr4 Mt4/Pu4
10. Pd3 B4 Fr4 R4
11. Pd3 Jr4 Jk4 / S4 /Pu4
12. Pd3 Jk4 G4/V4 /R4
13. Pd4 M4 Jr4 / S4 /Pu4
14. Pd4 Pu4 M4 Jr4 / Jk4
15. Pd4 Jk4 Gn4 Mt4 / Jr4
16. Pd4 Gn4 Jr4 Pu4 To4 / Gn4 Mt4
17. Pd4 To4 Jr4 F4 / Mt4
18. Pd4 Jk4 Jr4 G4 Pu4 / B4
19. Jk3 M4 Pu4 / G4
20. Jk3 Gn4 Pd4 Mt4
21. Jk3 Pd4 G4 B4 / Pu4
22. Jk3 Mt4 Gn4 G4 Pd5 / Jr4

Appendix 14.6 (contd)
Statement III (contd)

23. Jk4 Pu4 R4 Pd4 O4 / Mt4

24. Jk4 Pd4 Jr4 O4 R4 / Pu4
25. Jk4 Mt4 Gn4 Pu4 / O4 Jr4

26. Jk4 Mt4 B4 O4 / Pu4
27. Jk4 [illegible] Pu4 O4 Pd4

28. Jr3 Pu4 Pd4 / O4 / Jk4 /Gn4

29. Jr3 Pd4 Gn4 Pu4

30. Jr3 Gn4 Mt4 / Pd4

31. Jr4 Jk4 Pu4 O4

32. Jr4 Mt4 Pd4 To4 F4 / G4 R4

33. Jr4 Pu4 Jk4 / O4 Mt4 / T4 / Fd4 / Gn4

34. Gn2 B4 / Pd4

35. Gn3 Pd4 R4 / S4 / B4

36. Gn3 Jk4 Mt4 /Pd4

37. Gn3 Pd4 Pu4 Mt4 / R4 B4

38. Gn3 Pd4 Fb4 / B4 Pu4

39. Gn4 Mt4 C4. Jk4 / Jr4

40. Gn4 Mt4 Jk4 Jr4 / Pu4

41. O3 Jk4 B4

42. Pu3 Pd4 Mt4

43. Pu4 Pd4 B4 O4 / Jk4 Gn4 / Mt4 / Jk4

44. Pu4 M4 Jk4 Pd4

45. M3 Pd4 Jk4 / Pu4

46. M4 Pd4 Jk4 O4 / R4
47. To4 Mt4 Jr4 F4/ (Pd4 B4)
48. B4 R4 Pd4 O4
49. C3 Mt4 Jr4 / (Gn4 Jr4)
50. Mt3 B4 Pd4 Jk4 / Gn4
51. Mt4 B4 Pd4 Jk4 Ch4 / Jr4

Special

52. Pd4 Gn4 Fb4 B4 R4
53. Pd3 Gn4 Jk4 Mt5
54. Pd4 Mt4 Pu4 R4
55. R4 Pd4 Mt4 Pu4 Gn4
56. Mt4 Gn4 Pu4 R4 Jk4
57. Jk3 O4 Gn4
58. Jk4 Gn4 O4 Pu4 B4
59. Jk4 Jr4 O4 S4 V4
60. Jr4 Pd4 Pu4 G4

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Appendix 14.6 (contd)
Statement III (contd)

Assam

1. Pd1
2. Pd2 I4+
3. Pd2 Ju4+

Meghalaya

1. Pd2 C4+
2. Pd3 V4+ Fr4+

Tripura

1. Pd1

Manipur

1. Pd1

Nagaland

1. Pd2 Mt4+ / M4+

Mizoram

1. Pd1

Arunachal Pradesh

1. Pd1
2. Pd2 M4+ / Mt4+ / O4+

Bihar

1. Pd1
2. Pd2 Pu4 / W4 / M4 / Mt4
3. Pd3 Pu4 W4 / M4 / Ju4
4. Pd3 W4
5. Pd3 M4 Pu4 O4
6. Pd4 M4 W4 S4 / Ba4 / Pu4
7. Pu3 Pd4 W4
8. M3 Pd4 W4

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Appendix 14.6 (contd)
Statement III (contd)

Gujarat

1. Pd1
2. Pd2 Fr4
3. Pd3 Pu4 Jk4
4. Pd3 F4 Pu4 / Jk4
5. Pd4 Jk4 Gn4 C4 Pu4 / Mt4

6. B2 F4 /Jk4
7. B3 Gn4 Jk4 / S4
8. B3 Gn4 $\frac{\text{C4 Jk4}}{\text{F4}}$

9. B3 Gn3
10. B3 Jk4 F4 / O4
11. B3 F4 Jk4 Pu4 / W4
12. B3 Pd4 Mt5 To4 / W4
13. B3 W4 O4 F4 / Jk4
14. B3 Jk4 C4 W5

15. B4 Jk4 W4 C4 / Gn4 / O4/Pu4 / F4 / Mt5
16. B4 Jk4 Pd4 F4 / W4
17. Jk3 B4 Gn4 / W4
18. Jk3 O4 F4
19. Jk3 C4 Gn4 Pd 4 /Fr4
20. Jk4 Pd4 C4 Pu 4 / Fr4

21. Jr2 Gn4 W4
22. Jr4 Pd4 C4 Mt4

सत्यमेव जयते

Appendix 14.6 (contd)
Statement III (contd)

23. M3 W5 Pd4 / C4
24. M3 Pd4 Gn4 Mt4 / G4
25. M4 Pd4 Gn4 / B4 /G4
26. M4 C4 Gn4 Pd4 B4 / W4
27. M4 Mt4 W4 F4 B4
28. Gn1
29. Gn2 B4 / Jk4 / C4

30. Gn3 B3
31. Gn3 B4 Jk4 /C4
32. Gn3 C4 F4 / Jr4
33. Gn4 B4 C4 M4 / Pd4
34. Gn4 Pu4 B4 F4 / Jk4
35. Gn4 Jr4 F4 B4

36. C1
37. C2 Jr4 / Jk4 / B4
38. C3 Jk4 B4 / W4 / Pd4
39. C3 Jr4 Jk4 / Pd4
40. C3 Jr4 Pd4 To4 / Mt4 / (B4, To4)
41. C4 Pd4 B4 M4 / To4
42. C4 Pd4 Jr4 Fy4 / Pu4
43. C4 Pd4 Mt4 Gn4 / Jr4 / Jk4 / (Gn4, M4)

44. To3 B4 Pd4

Appendix 14.6 (contd)
Statement III (contd)

Special

45. Pd3 W4 B4 C4
46. B4 M4 Pd4 R4
47. W4 B4 C4 Pd4
48. Pu4 F4 Jk4 B4
49. Gn4 B4 C4 Pd4
50. C4 Gn4 M4 B4
51. R3 Mt4 04 Pd4

सत्यमेव जयते

Haryana

1. B3 G3
2. B3 G4 W4

3. G3 W4 B4 C4
4. G4 B4 W4 C4 / J4

5. W3 Pd4 M4 / G4
6. W3 Pd4 G4 S4 / J4
7. W3 G4 B4 S4 /J4
8. W3 G4 B4 Ba4
9. W4 Pd4 M4 G4
10. W4 G4 B4 J4 Ba4

सत्यमेव जयते

Appendix 14.6(contd)
Statement III (contd)

Himachal Pradesh

1. W3 M3
2. W3 M3 Pd4/ G4
3. W3 M4 Pd4/G4/Pt4/Ba4/Ba4 Mt4
4. W4 M4 Mt4
5. W4 Ba4 Pt4 Mt4/Mt4 Pd4
6. M2 W2
7. M3 W3
8. M3 W3 G4/Pd4
9. Ba2 W4/Pu4
10. Ba3 Mt4 W4
11. Mt1
12. Mt3 Ba4
13. Pt3 W4 M4
14. Fr4 W4 M4/Mt4

सत्यमेव जयते

Appendix 14.6 (contd)
Statement III (contd)

Jammu & Kashmir

1. M1
2. M2 W4
3. M3 W3
4. M3 W4 Ba4 / Pu4 / Mt4 / Pd4
5. Mt3 W4/ (W4 Pu4)
6. W3 M3
7. W3 M4 Pd4 / B4
8. Pd3 M4 W4 / O4 / V4
9. Pd3 M4 Pu4 / W4
10. Pd3 M3
11. Pd3 W3
12. Pd2 M4

सत्यमेव जयते

Appendix 14.6 (contd)
Statement III (contd)

Karnataka

1. L2 Pd3
2. L3 Pd3
3. Gn3 B4 R4
4. Gn4 Jk4 To4 S5
5. Gn3 Jk4 C4 / W4 / Pu4
6. Gn4 Jr4 Jk4 B4 / W4
7. Pu4 G4 Jk4 $\dfrac{\text{Jr4}}{\text{Jr5 Mt5 Gn5}}$
8. Pu4 Mt4 O4 B4 Jr4
9. Pu4 T4 Jr4 Gn4 O4 / Jk4
10. Pu4 Gn4 Mt4 Jk4 W4 C4
11. Pu4 Jk4 Mt4 B4 / Gn4 / R4 Gn4
12. Jr4 Mt4 Gn4 Pu4
13. Jr4 B4 Jk4 Gn4
14. Jr4 B4 Jk4 Gn4 / W4 / M4
15. Jr3 G4 Pu4 Jk5
16. Jr3 O4 Gn4 T4 / C4 / T4 B4
17. Jr3 O4 T4
18. Jr3 B4 Gn4 / C4
19. Jk3 Pu4 R4 / Gn4
20. Jk4 Pu4 R4 Pd4 / Gn5 Pd5
21. Jk4 C4 Gn4 R4 / Pu4
22. Jk4 Mt4 B4 Gn4 / C4 / C4 Pu4
23. Jk4 C4 Gn4 W4 / Pu4 Pd4 Jr4

Appendix 14.6 (contd)
Statement III (contd)

24. C4 Jk4 Gn4
25. C3 Jk4 Mt4
26. C3 W4 Jr4
27. C3 Jr4 Mt4 / Pd5

28. C4 Jk4 Pu4 Mt4 Gn4 / S4 / Pd4
29. C4 Mt4 Jr4 Jk4 Pu4
30. C4 Jr4 Jk4 Mt4 / Gn4 / Gn4 Pu4 / B4 / B4 Mt4

31. R2 Pu4/Pd4 / Pu4 Pd4 / Pu4 Pd5 / Pu4 Mt4

32. R3 Pd4 Pu4 L4 / Jk4
33. R3 Pu4 Nf4
34. R3 Gn4 Pd4 / Mt4 / Pu4 / Pu4 Pd4
35. R3 Pu4 Pd4 / L4

36. R4 L4 Pu4 Mt4 / Jk4 / Pd4 / Mt4 Jk4

37. Mt4 R4 Jk4 Pu4

38. Pd1
39. Pd2 L4 / B4 / M5 / V4 / F4
40. Pd3 R4 L4 / Pu4

41. Pd4 R4 F4 Jk5
42. Pd4 C4 Jk4 Mt4 Ch4
43. Pd4 C4 Gn4 Pu4

सत्यमेव जयते

Appendix 14.6 (contd)
Statement III (contd)

44. Pd4 R4 Jk4 Gn4 / Pu4

45. Pd4 R4 Pu4 S4 / Jk4

46. Pd4 R4 Pu4 / L4

47. W3 C4 Jk4 / Jr4

48. Nf2 Pd4 R4

49. [illegible] E4 Jk4 M4 Pu4 Gn4

Nf = Non-food crops

सत्यमेव जयते

KERALA

1. L2 Pd4 (Ta4)
2. L3 Pd3 (Ta4)
3. L3 Ta4 Pd4

4. Pd2 L4
5. Pd3 L3

सत्यमेव जयते

Madhya Pradesh.

1. Pd1

2. Pd2 Mt4 / Pu4

3. Pd3 Mt3
4. Pd3 Mt4 Pu4 / G4 / 04 / W4
5. Pd3 W4 G4 / Mt4 / 04
6. Pd3 Mt4 Pu4 W4
7. Pd3 W4 G4 Mt4 / Pu4
8. Pd4 G4 W4 Jk4 Ba4
9. Pd4 Mt4 G4 04 W4

10. W2 G4 / Pu4 / Jk4 / F4

11. W3 Pd4 04 / G4
12. W3 G4 Jk4 / Pd4 / 04 / Pu4
13. W3 Jk4 F4 / G4 / 04 / C4
14. W3 04 C4 / Pu4
15. W3 04 Pu4 G4
16. W3 Jk4 G4 F4 / Pu4
17. W3 F4 Pu4

18. W4 Pd4 Mt4 G4 / 04
19. W4 Pd4 Mt4 G4 04
20. W4 Mt4 F4 04 Ba4
21. W4 Mt4 F4 Jk4 / Pd4
22. W4 Jk4 04 F4 / G4

सत्यमेव जयते

23. W4 Jk4 O4 F4 Mt4 M4 Pu4
24. W4 G4 F4 Pu4 Jk4 / C4
25. W4 G4 Pu4 O4

26. Jk3 C3
27. Jk3 C4 Pu4 / F4/Gn5 / W5
28. Jk3 W4 F4 / G4 / Pu4
29. Jk3 Gn4 T4
30. Jk3 C4 B4 Pu4 / W4
31. Jk3 W4 F4 C4 / G4
32. Jk3 F4 C4 M4 / W4
33. Jk3 F4 Gn4 M5
34. Jk3 Pu4 F4 Gn4 / W4

35. Jk4 F4 W4 G4 / C4
36. Jk4 F4 W4 G4 Pu4
37. Jk4 Mt4 W4 O4 G4
38. Jk4 Mt4 W4 Pu4 G4 / T4
39. Jk4 M4 Pu4 C4 Gn4 / W4
40. Jk4 C4 Gn4 Pu4 / W4

41. C3 Jk4 Pu4

42. C4 Jk4 Pd4 Mt4
43. C4 Pu4 Mt4 Gn4 F4
44. C4 Gn4 W4 G4 Pu4 / F4

Appendix 14.6 (contd)
Statement III (contd)

45. G4 W4 04 B4 / Jk4

46. G4 W4 04 Ba4

47. G4 W4 Pu4 Jk4

48. Pu3 Jk4 B5 C5

49. Pu4 W4 G4 Jk4

50. Mt3 Pd4 04 / Ba4

51. Mt3 W4 G4 Jk4

52. Mt4 Pu4 Jk4 M4 / B4

53. M3 Jk4 Pd4 Mt4 / C4

54. M4 Jk4 C4 F4 Mt4

55. B3 04 W4 / G4

56. F4 Jk4 W4 G4

57. F4 W4 M4 Jk4 Gn4

सत्यमेव जयते

Maharashtra

1. Pd1
2. Pd2 R4
3. Pd2 R4 Mt4
4. Pd2 Jr4
5. Pd2 Pu4
6. Pd2 Fr4 R4
7. Pd3 R4 Mt4
8. Pd3 Fr4 L4
9. Pd3 Gn4 Jk4 S4
10. Pd3 R4 Jr4 Mt4
11. Pd3 R4 Mt4 S4
12. Pd3 R4 C4 W4
13. Pd3 Jr4 Pu4
14. Pd4 Gn4 Jk4 Jr4 R4
15. B1
16. B2 Pu4
17. B2 Pu4 (Jr4)
18. B3 W4
19. B3 Jr3
20. B3 Jr4 Pd5 Gn5
21. B3 Pu4 Gn4 R5
22. B3 Pu4 C4 Jr4 W5
23. B3 Jr4 Pu4 C4 O5
24. B3 Jr4 Pu4
25. B3 Gn4 Pu4 C4

26. B3 R4 Pd4 Pu5

27. B3 Jk3 Gn4

28. B4 W4 R4 Pd4 Pu4

29. B4 Jr4 Gn4 Jk4

30. Jr1

31. Jr2 B4

32. Jr2 T4 Gn4

33. Jr2 Pu4 O5

34. Jr3 B4 Pu4 O4

35. Jr3 B4 O5 W5

36. Jr3 B4 S4

37. Jr3 B3

38. Jr3 Pd4 R4 Gn4 (R5)

39. Jr3 Gn4 B4 Pu4 Pd4

40. Jr3 B3 Pd4

41. Jr3 B4 Pu4 O4

42. Jr3 C4 Pu4 O4/ B4

43. Jr3 Pd4

44. Jr4 W4 O4 Pd4 C5 (Jk4)

45. Jr4 Pu4 Gn4 W4

46. Jr4 B4 Pu4 O4 W4

47. Jr4 Gn4 Pu4 O4 T4

48. Jk3 C4 Pu4

49. Jk3 C3 Pu4

50. Jk3 C4 T5

51. Jk3 C4 Gn4 Pu4

52. Jk3 Gn4 Pu4 S4

53. Jk3 Mt4 Pd4

54. Jk4 C4 Pu4 Jr4 O4

55. Jk4 C4 Pu4 Jr4 O5 Gn5

56. Jk4 Pu4 Gn4 O4 W5

57. Jk4 Gn4 Pu4 O4 T4

58. Jk4 Pu4 B4 Gn4 O4 W5

59. Jk4 Pd4 C4 Mt4

60. Mt3 Pu4 C4 Jr4 Gn4

61. R3 Mt4 O4 Pu4 Pd4

62. W3 R4 Pu4 O5 G5 Fr5

63. C2 Jk4

64. C3 Jk3

65. C3 Pu4 Jk4

66. C3 Pu4 Jk4 Gn5

67. C4 Jr4 Pu4 Jk4

68. C4 Pu4 Jk4 B4

69. C4 Pu4 Jr4 B4

70. Gn4 Pd4 Jk4 Mt4

71. Gn4 Jk4 Jr4

72. Pu4 Jk4 C4 B4

सत्यमेव जयते

Appendix 14.6 (contd)
Statement III (contd)

Orissa

1. Pd1
2. Pd2 Pu4/ R4/G4/O4/Mt4/Pu4 O5/O4 Pu5
3. Pd3 Pu3
4. Pd3 Pu4 Mt4/ R4
5. Pd3 Pu4 O5 Mt5
6. Pd3 Mt4 M4 O4
7. Pd3 R4 O4 Mt5
8. Pd4 R4 O4 V4 / M4 / Mt4 Pu4 / Mt4 Pu5
9. R4 Pd4 O4 Mt4 / T4

Punjab

1. W3 Pd4 F4 / M4
2. W3 F4 M4 / C4 / Gn4 / Pd4
3. W3 F4 G4 B4 / Pd4
4. W3 F4 M4 C4
5. W4 M4 G4 F4 / Pd4
6. C4 W4 G4 / F4

सत्यमेव जयते

Appendix 14.6 (contd)
Statement III (contd)

Rajasthan

1. B1
2. B2 Pu4 / F4 / Jk4
3. B3 Pu3 / F3
4. B3 Pu4 F4
5. B3 O4 Jk4 / F4 / Pu4
6. B3 G4 W4 / Ba4
7. B3 Pu4 G4 Ba4 / F4
8. B3 G4 W4 Gn4
9. B3 O4 Pu5 Jk4 / W4
10. B4 O4 Pu4 Mt4 / F4
11. B4 W4 O4 / Ba4 / Pu4 / Gn4
12. B4 Ba4 W4 Pu4 / G4 / O4 / Gn 4

13. G3 F4 B4 / W4 / C4
14. G4 W4 B4 Jk4 / O4
15. G4 W4 B4 Jk4 / Ba4

16. M1
17. M2 Mt5 W5
18. M2 Pu4 Gn4 / Ba4
19. M2 W4 Ba4 / Mt4 / Gn4
20. M3 Pd4 W4 G4 / Mt4
21. M3 W4 Ba4 O4 / Gn4 / C4
22. M3 W4 O4 Mt4 / Pu4

23. M3 O4 Ba5 (Pu4 / W4 / C4)

24. M4 Jk4 B4 Ba4

25. M4 W4 Jk4 Gn4 / C4

26. M4 Pd4 G4 Mt4 C4 / W4

27. M4 W4 Ba4 (F4 / Jk4) O5

28. C4 W4 F4

29. W3 Jk4 G4 / O4

30. W4 F4 G4 C4 / O4

31. W4 Jk4 G4 B4

32. W4 G4 B4 O4

33. Jk3 W4 G4 / M4 / C4 / Pu4

34. Jk3 C4 M4 B4 / W4

35. Jk3 B4 (G4 W4) / (C4 Pu4)

36. Jk4 W4 G4 M4

37. Jk4 B4 O4 Pu4 / M4

38. Pu2 B3

39. Pu3 B3

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40. F3 O4 M4

41. F4 B4 O4 Jk4

42. C4 F4 B4 Pu4 / M4

Special M3 Pd4 Jk4

सत्यमेव जयते

Appendix 14.6 (contd)
Statement - III (contd)

Tamil Nadu

1. Pd1
2. Pd2 Gn4 / R4
3. Pd3 Gn3
4. Pd3 Gn4 Mt4 / B4 / Jk4
5. Pd3 Gn4 B4 L4
6. Pd3 Gn4 Mt4 Jk4 / B4
7. Pd3 Jk4 B4 Gn4
8. Pd3 Jk4 Gn4 Pu4 / Jr4
9. Pd3 Jk4 Jr4 Mt4 / B4
10. Pd3 Mt4 B4 C4 / L4
11. Pd3 C4 B4
12. Pd3 Pu4 Gn5 Os5 / Fr5
13. Pd3 Ta4 L4
14. Pd4 Gn4 Mt4 Jk4 R4 / B4 (Pu4) / (S4)
15. Pd4 B4 Gn4 Jk4 R4 / C4
16. Pd4 Mt4 Gn4 C4 B4
17. Pd4 B4 Jr4 Gn4 Mt4 Jk5
18. Pd4 Jk4 Pu4 Jr5 Mt5
19. Jk3 C4 Pu4
20. Jk3 C4 Pu4 Gn4
21. Jk3 Pd4 Mt4 B4 / Gn4
22. Pu4 Mt4 Jk4 R4 / Gn4 / Pd5
23. Pu4 Jr4 Pd4 B4 Jk4
24. R3 Pu4 O4
25. R4 Jk4 Pu4 Gn4

सत्यमेव जयते

26. B3 C4 Mt4

27. B3 O4 Jk4

28. B4 Gn4 Jr4 Pd4

29. B4 Jk4 Mt4 Gn4 Jr4

30. Gn3 Pd4 S4 Jr4

31. Gn3 Jk4 B4 Pd4

32. Gn4 Pd4 Mt4 V4 Jk4 / Jr4

33. C3 B4 Mt4 / F4 / Pd4

34. C4 Mt4 Pd4 F4 Gn4 / B4

35. Pd4 Pu4 Mt4

Special

36. L1

37. L2 Pd4

38. L3 Pt3

39. Fr3 L4 Pt4

40. Jk4 Pd4 Mt4 Gn4 C4/Jr4

41. Jr3 Pu4 Mt4 Pd4

42. Gn3 Jk4 Mt4 L4 Pd5

43. C4 Jk4 Pd4 Pu4 Mt4

44. Pd4 B4 Gn4 C4 B4 (Ba4)

45. Jk3 Pd4 Mt4 (B4)

Appendix 14.6 (contd)
Statement III (contd)

Uttar Pradesh

1. Pd2 W4
2. Pd3 W4 M4 / Pu4 / G4 / Ba4 / S4 / Mt4 / G5
3. Pd3 W4 G4 Pu5
4. Pd3 W4 Pu4 G5 / Mt4 / M4
5. Pd3 Ba4 Pu4
6. Pd3 Ba4 Pu4 W4 / T4 / $\frac{S4}{5}$ / M4 / G4
7. Pd3 W4 Ba4 Pu4 / Jk4/M4
8. Pd4 W4 S4 / G4
9. Pd4 W4 S4 G4 / M4 / Pu5
10. Pd4 W4 Ba4 G4 / Pu4 / Mt4 / Jk4 / M4
11. Pd4 W4 Ba4 B4 G4 / Pu4 / Pu5
12. Pd4 W4 Ba4 B4 G4 Mt4
13. Pd4 W4 Ba4 Jk4 / Pu4 / G4 / Mt4
14. Pd4 W4 Ba4 Jk4 Pu4
15. Pd4 W4 Ba4 G4 M4
16. Pd4 W4 Ba4 B4 Pu5 S5 B5
17. Pd4 W4 Ba4 Pu5 S5 B5

18. G3 W3 / W4
19. G3 W4 B4 / Jk4 / T4 / Pd4
20. G4 Pd4 Ba4 B4
21. G4 W4 Pd4 Ba4 Jk4 / B4 / M4 / Pu4
22. G4 Jk4 T4 B4 / W4

23. S3 W4 F4

24. B4 G4 T4

25. B4 W4 G4 O4

सत्यमेव जयते

26. M3 Pd4 W4

27. M4 Pd4 W4

28. Ba4 M4 Pd4 W4

29. Ba4 Pd4 W4 B4 G4

30. Mt3 Pd4 Ba4 / M4

31. W3 S4 F4 / Pd4 / M4

32. W3 S4 F4 M4

33. W3 S4 Pd4 G4/ F4 / B4

34. W3 Jk4 Mt4

35. W3 G4 Pd4

36. W3 G4 B4 $\frac{\text{Pu4}}{5}$ / O4

37. W3 B4 M5 Ba5

38. W3 B4 M4 Gn4 Pu5 / G5

39. W3 M4 G5 V4 / V5 B5

40. W3 M4 S4 Pd5 B4 / Gn4

41. W3 Ba4 G4 F5 B4 / Jk4

42. W3 M4 Jk4 G4 Pu4

43. W4 Pd4 S4 F4 / M4 / G4 / G5 / O4 / Gn4 / G5 Pu5

44. W4 Pd4 M4

45. W4 Pd4 M4 G4 / S4 / B4

46. W4 Pd4 G4 B4 M4 / O4 / M4 Ba4 / S4

47. W4 Pd4 G4 Ba4 Jk4 / M4 / M4 Ba4

48. W4 Pd4 G4 Pu5 S5 / B5

49. W4 Pd4 G4 Jk5 B5 M5 / S5

50. W4 Pd4 B4 G4 / M4

51. W4 Pd4 G4 S4 / Gn4 / S5

52. W4 M4 B4 Pu4 Ba4 / Pd4 / G4

53. W4 M4 B4 Pu4 / Pd4

54. W4 M4 B4 Gn5 G5 / Pd5

55. W4 M4 Pd4 B5 Pu5

56. W4 M4 Pd4 Gn4 Ba4 / G4

57. W4 M4 R4 Mt4

58. W4 M4 G4 Pd4

59. W4 M4 S4 Pu5

60. W4 B4 Pd4 G4 M4 / O4 / M4 Ba4

61. W4 B4 G4 Pu4 / Pd4 / M4 / O4

62. W4 S4 F4 G4 / M4 / Pu4

63. W4 B4 G4 Gn4 Pu5 M5

64. W4 Gn4 G4 Ba4 M4 / Pd4

West Bengal

1. Pd1
2. Pd3 Pu4 Ju4
3. Pd3 Pu4
4. Pd3 M4 Te4

सत्यमेव जयते

Statement IV - Number of Cropping Patterns - Statewise

Cropping pattern	Kerala	Tamil Nadu	Karnataka	Andhra Pradesh	Maharashtra	Madhya Pradesh	Gujarat	Rajasthan	Haryana	Punjab	Jammu & Kashmir	Himachal Pradesh	Uttar Pradesh	Bihar	Orissa	West Bengal	Assam
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
d1		1	1	1	1	1	1							1	1	1	1
d2	1	1	1	1	5	1	1				1		1	1	1		2
d3	1	11	1	11	7	5	3				4		6	3	5	3	
d4		7	6	8	1	2	1						9	1	1		
[illegible]1																	
[illegible]2																	
[illegible]3		4	1	5	6	9	3	3									
[illegible]4		1	4	7	6	6	1	2									
[illegible]1					1												
[illegible]2					3		1										
[illegible]3		1	4	3	10												
[illegible]4			3	4	4		1										
[illegible]								1			1						
[illegible]								3			1	1					
[illegible]				1		1	2	5			2	2	1	1			
[illegible]				1		1	3	4					1				
[illegible]					1			1									
[illegible]					2		1	1									
[illegible]		2			10	1	8	7	2								
[illegible]		2	1	1	2		3	3					2				
[illegible]1												1					
[illegible]2																	
[illegible]3				1	1	2					1	1	1				
[illegible]4			1	2		1											
[illegible]																	
[illegible]			1														
[illegible]		1	4		1		1										
[illegible]		1	1	1											1		
[illegible]																	
[illegible]2						1											
[illegible]3			1		1	7		1	4	4	2	3	12				
[illegible]						9	1	3	2	1		2	22				

Appendix [illegible] Statement [illegible] (contd.)

Cropping pattern	Kerala	Tamil Nadu	Karnataka	Andhra Pradesh	Maharashtra	Madhya Pradesh	Gujarat	Rajasthan	Haryana	Punjab	Jammu & Kashmir	Himachal Pradesh	Uttar Pradesh	Bihar	Orissa	West Bengal	Assam
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
T1																	
T2																	
T3																	
T4																	
Pu1																	
Pu2								1									
Pu3				1		1		1						1			
Pu4		2	5	2	1	1	1										
S1																	
S2																	
S3													1				
S4																	
Gn1							1										
Gn2				1			1										
Gn3		3	2	4			3										
Gn4		1	2	2	2		4										
01																	
02																	
03				1													
04																	
C1							1										
C2					1		1										
C3		1	3	1	3	1	3										
C4		2	4		3	3	4	2		1							
Ba1																	
Ba2												1					
Ba3													2				
Ba4													4				
L2	1	1	1														
L3	2	1	1														
L4																	
[illegible]		1															

Appendix 14.6 (contd)

Cropping pattern	Kerala	Tamil Nadu	Karnataka	Andhra Pradesh	Maharashtra	Madhya Pradesh	Gujarat	Rajasthan	Haryana	Punjab	Jammu & Kashmir	Himachal Pradesh	Uttar Pradesh	Bihar	Orissa	West Bengal	Assam
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
F1																	
F2																	
F3								1									
F4						2		1									
G1																	
G2																	
G3								1	1				2				
G4						3		2	1				3				
Nf1																	
Nf2			1														
Nf3																	
Nf4																	
Fr1																	
Fr2																	
Fr3		1															
Fr4																	
|												1					
/																	
Pt1																	
Pt2																	
Pt3																	
Pt4																	
To1												1					
To2																	
To3							1										
To4					1												

Appendix 14.6

(Paragraph 14.6.3)

Statement V - Basic Information for Each Rainfall Region

Notes

1. The first column contains the Rainfall Pattern of the Rainfall Region and all-India Zone numbers included in the Region. The all-India Zone numbers denote the number in the all-India Zonal list given in Appendix 14.4, Statement VI. For symbols etc sections 14.4 and 14.5 should be consulted.

2. For facility of reference, the numbers of the Rainfall Zones of the States included in the Region are given in column 5.

3. The geographical area included in column 6 is based on reporting areas of taluks etc.

4. The cropping patterns given in the last column are in respect of the State areas included in the Region.

5. GIA = Gross Irrigated Area.
   GCA = Gross Cropped Area.
   na = Not available.

REGION - I

Rainfall Pattern/ All-India Zone no(s)	State	District	Taluk	Rain-fall zone no(s) in the State	Geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping Patterns
E4(E4)E4 169	Rajasthan	Jaisalmer	Jaisalmer, Pokar	I	11,356	2551	0.1	B1 B2 Pu4/F4/JK4 B3 Pu3/F3 Pu2 B3 Pu3 B3 G3 F4 B4/W4/C4 C4 W4 F4 W4 F4 G4 C4/04
		Barmer	Pachpadra, Sheo				2.5	
		Jodhpur	Shergarh, Phalodi				2.9	
		Bikaner	Kolavat, Lunkaransar, Bikaner, Nokha				0.1	
		Churu	Sardar Shahr, Dungargarh				0.03	
		Ganganagar	Karanpur, Ganganagar, Padampur, Raisinghnagar, Anupgarh, Sangaria, Hanumangarh, Tibi, Nohar, Sadul Shahr, Suratgarh				49.4	
	Haryana	Hissar	Dabwali, Sirsa, Fatehabad	I	666	722	49.0	G3 B4 W4 C4 G4 B4 W4 C4/Jk4

REGION - I (contd)

Rainfall Pattern/ all-India Zone no(s)	State	District	Taluk	Rain-fall zone no(s) in the State	Geographi-cal area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping Patterns
	Punjab	Firozpur	Fazilka, Muktsar	I, II	797	817	92.0	C4 W4 F4/G4
		Bhatinda	Bhatinda				70.0	
	Jammu & Kashmir	Ladakh	Leh, Zanskar, Kargil	I, V	350	215	100.0	Pd2 M4 Pd3 M4 W4/04/V4 Mt3 W4/(W4 Pu4)
		Anantnag	Anantnag, Pulwama, Shupiyan, Tral, Pahalgam				60.0	
		Srinagar	Srinagar, Beerwah, Chadura, Ganderbal, Badgam				68.3	
	Himachal Pradesh	Lahul & Spiti	Lahul, Spiti	XII	362	6	100.0	Ba2 Pu4/W4 Ba3 Mt4 W4 Mt3 Ba4
		Chamba	Pangi				12.3	
	Total				13,531	4311		

REGION - II

Rainfall Pattern/ all-India Zone no(s)	State	District	Taluk	Rain-fall zone no(s) in the State	Geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping Patterns
E4(C1E3)E4	Rajasthan	Barmer	Chohten, Barmer	II	1605	286	3.6	B1
135,136,137	Gujarat	Kutch	Bhuj, Mundra, Mandvi, Anjar, Abdasa, Rapar, Bhachau, Lakhpat, Nakhatrana	I,II	2740	1063	100.0	Gn2 B4/Jk4 Gn3 B3 Gn3 B4 Jk4/C4 Gn4 Pu4 B4 E4/Jk4 B3 Gn3 B3 F4 Jk4 Pu4/W4
		Jamnagar	Okhamandal(Dwarka), Kalyanpur				8.8	Jk3 C4 F4 Pu4 F4 Jk4 B4
		Amreli	Lilya, Vathi, Khambha, Dhari, Amreli, Babra				7.4	
		Bhavnagar	Savarkundla, Gariadhar				8.8	
	Maharashtra	Sholapur	Pandharpur, Sangola, Malsiras, Mangalwedha, Karinala, Madha		2600	1961	10.4	Jr1 Jr2 B4 Jr2 Pu4 05 Jr3 B3 Jk3 Gn4 Pu4 S4 B2 Pu4(Jr4) B3 Jk3 Gn4

REGION - II (contd)

Rainfall Pattern/ all-India Zone no(s)	State	District	Taluk	Rainfall zone no(s) in the State	Geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping Patterns
		Poona	Baranati, Dhond(½E), Indapur				10.7	
		Satara	Phaltan(½E), Vaduj (Khataw), Dehiwadi (Man)				13.7	
		Ahmednagar	Shrigonda, Karjat				13.0	
		Sangli	Meraj, Tasgaon, Atpadi, Kavanthe Mahankal, Jath, Vita(Khanapur)				10.5	
	Andhra Pradesh	Anantapur	Gooty, Tadpatri, Kalyandurg, Rayadurg, Uravakonda	V, VI, XXII	1504	843	15.4	Gn3 Jk4 Mt4/Pd4 Gn4 Mt4 C4 Jk4/Jr4 Gn4 Mt4 C4 Jr4
		Kurnool	Pattikonda, Dhone				12.7	Jk3 Gn4 Mt4 Pd5 Jk4 Mt4 Gn4 Hu4/C4 Jr4
		Cuddapah	Pulivendla, Jammalamadugu				31.5	

REGION - II (contd)

Rainfall Pattern, all-India Zone no(s)	State	District	Taluk	Rainfall zone no(s) in the State	Geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping Patterns
	Karnataka	Bijapur	Bijapur, Bagawadi, Jamkhandi, Bilgi, Mudhol, Indi, Sindgi, Muddebihal, Hungund, Badami, Bagalkot	I,VI	4885	3818	3.8	C3 W4 Jr4 C3 Jr4 Mt4/Pd5 C4 Jk4 Pu4 Mt4 Gn4/S4/Pd4 C4 Jr4 Jk4 Mt4 Gn4/Gn4 Pu4/B4 B4 Mt4 W3 C4 Jk4/Jr4 Gn3 Jk4 C4/W4/Pu4 Gn4 Jr4 Jk4 B4/W4 Gn4 Jk4 To4 S5
		Raichur	Lingsugur(2/3W), Sindhanur, Koppal, Kushtagi, Yelburga Gangawathi				10.9	Jk4 C4 Gn4 B4/Pu4 Jk4 C4 Gn4 W4/Pu4 Pd4 Jr4 Jk4 Mt4 B4 Gn4/C4/C4 Pu4 Jr3 B4 Gn4/C4 Jr4 B4 Jk4 Gn4 Jr4 B4 Jk4 Gn4/M4/W4
		Bellary	Bellary, Siruguppa, Sandur,Kudligi, Harpanahalli,Hospet, Malapuram,Hadagalli				9.9	B4 Jk4 M4 Pu4 Gn4 Pu4 Gn4 Mt4 Jk4 W4 C4
		Dharwar	Nargund, Navalgund, Gadag,Ron,Mundargi				5.3	

REGION - II (contd.)

Rainfall Pattern/ all-India Zone no(s)	State	District	Taluk	Rainfall zone no(s) in the State	Geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping Patterns
	Karnataka	Belgaum	Saudatti, Ramdurg, Gokak, Athani, Raibag, Chikodi				10.8	
		Chitra-durga	Molakalmuru(½N)				18.5	
					13,334	7971		

REGION - III

Rainfall Pattern/ all-India Zone no (s)	State	District	Taluk	Rain-fall zone no(s) in the State	Geogra-phical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping patterns
E4(G2 E2)E4	Rajasthan	Jodhpur	Jodhpur, Osian, Bilara	III IV	10054	5938	2.9	B1 B2 Pu4/F4/Jk4 B3 Pu3/F3 B3 Pu4 F4 B3 O4 Jk4/F4/Pu4 B3 O4 Pu5 Jk4/W4 B3 Pu4 G4 Ba4/F4 B4 O4 Jk4/F4/Pu4 B4 O4 Pu5 Jk4/W4 B4 Ba4 W4 Pu4/G4/ o4/Gn4 M2 Pu4 Gn4/Ba4 M3 O4 Ba5(Pu4/W4/ C4) M3 W4 Ba4 O4/Gn4/ C4 M4 Jk4 B4 Ba4 M4 W4 Ba4 (F4/Jk4) O5 Pu3 B3 G3 F4 B4/W4/C4 F4 B4 O4 Jk4 O4 F4 B4 Pu4/M4 Jk4 B4 O4 Pu4/M4 Jk4 W4 G4 M4
117,118 119,128,130		Barmer	Siwana				3.6	
		Jalor	Jalor Jaswantpura, Sanchore, Ahore				15.6	
		Jhunjhunu	Khetri, Udaipurwati, Jhunjhunu Chirawa				4.0	
		Sikar	Neem-Ka-Thana, Danta-Ramgarh, Fatehpur, Sikar, Lachmangarh, Srimadhopur				8.6	
		Nagaur	Ladnu, Didwana, Nawa, Parbatsar, Degana, Jayal, Nagaur, Merta				2.4	

REGION - III (contd.)

Rainfall Pattern/ all-India Zone no (s)	State	District	Taluk	Rain-fall zone no(s) in the State	Geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping pattern
	Rajasthan	Churu	Sujangarh, Rajgarh, Ratangarh, Churu, Taranagar				0.03	
		Pali	Jaitaran, Sojat, Pali, Raipur, Kharchi				15.0	
		Ganganagar	Bhadra				49.4	
		Sirohi	Sheoganj				22.6	
		Udaipur	Bhim, Deogarh Amet, Rajsamand				24.2	
		Bhilwara	Raipur, Asind, Mandal Hurda				44.2	
		Ajmer	Beawar, Ajmer, Kishangarh, Sarwar				23.1	

REGION - III (contd)

Rainfall Pattern/all-India Zone no(s)	State	District	Taluk	Rain-fall zone no(s) in the State	Geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping patterns
	Rajasthan	Jaipur	Kotputli, Bairath, Amber, Jamwa Ramgarh, Phulera, Jaipur, Sanganer, Chaksu, Phagi, Dudu				24.8	
		Tonk	Malpura				15.4	
	Gujarat	Mehsana	Chanasma, Harij, Sami	III, IV	2037	1419	23.7	B2 F4 B3 Jk4 F4/C4(W5) B3 Gn4(C4 Jk4)/F4 B3 Gn4 Jk4 B4 Jk4W4O4/C4/Gn4 C2 Jk4/B4 C3 Jk4 C3 Jk4 B4 Gn3 Jk4 B4 Jk3 B4 Gn4/W4
		Jamnagar	Jodiya				8.8	
		Banaskantha	Vare, Tharad, Deodar, Santalpur, Dhanera, Radhanpur, Kankrej				13.2	
		Surendranagar	Sayla, Dasada, Limbdi, Wadhwan, Muli				5.9	

REGION - III (contd)

Rainfall Pattern/all-India Zone no (s)	State	District	Taluk	Rain-fall zone no(s) in the State	Geogra-phical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping pattern
	Gujarat	Bhavnagar	Umrala, Gadhada, Sehor, Vallabhipur				8.8	
	Maharashtra	Ahmednagar	Sangamner, Ahmednagar, Rahuri, Shrirampur (½W), Kopargaon(½W), Parner, Akola	II	1695	1261	13.0	B1 B3 Jr3 B3 W4 B3 R4 Pd4 Pu5 B4 Jr4 Gn4 Jk4 Jr2 B4 Jr3 B4 S4 Jr3 B3 Jk3 Gn4 Pu4 S4 Pd3 Gn4 Jk4 S4 Gn4 Pd4 Jk4 Mt4
		Nasik	Sinnar, Niphad,				11.7	
		Poona	Purandhar, Sirur				10.7	
		Satara	Koregaon, Khandala				13.7	
		Kolhapur	Shirol, Hatkanangale				13.5	
		Sangli	Islampur(Walva)				10.5	
	Haryana	Hissar	Bhiwani, Loharu, Hissar, Hansi	II	1947	2320	49.0	B3 G3 W3 G4 B4 S4/J4 W3 Pd4 G4 S4/J4 W3 Pd4 M4/G4 G4 B4 W4 C4/J4
		Mohindergarh	Dadri				9.3	
		Rohtak	Rohtak, Gohana, Jhajjar				40.3	
		Karnal	Kaithal, Gulha				68.2	
		Jind	Safidon, Jind, Narwana				59.6	

REGION - III (contd)

Rainfall Pattern/all-India Zone no (s)	State	District	Taluk	Rain-fall zone no(s) in the State	Geogra-phical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping pattern
	Punjab	Kapurthala	Phagwara, Kapurthala, Sultanpurlodhi	III	2566	2989	73.0	W3 F4 M4/C4 W3 Pd4 M4/F4 W3 F4 M4 C4 W3 F4 G4 B4/Pd4
		Jullundur	Jullundur, Nakodar, Phillaur				81.0	
		Ferozepur	Moga, Zira, Ferozepur				92.0	
		Sangrur	Malarkotla, Barnala, Sangrur, Sunam				80.0	
		Bhatinda	Mansa, Faridkot, Rampura Phul				70.0	
		Patiala	Sawana				80.0	
		Gurdaspur	Batala				82.0	
		Amritsar	Ajnala, Amritsar, Patti, Taran-Taran				57.0	
	Himachal Pradesh	Mahasu	Rohru, Rampur	IV	39	41	8.0	W3 M4 Ba4 Mt4 W4 Ba4Mt4M4/Pt4/Pt4
	Andhra Pradesh	Cuddapah	Proddatur, Kamalapuram Cuddapah	IX	324	159	31.5	Pd3 Gn4 Jk4 Mt5 Gn3 Pd4 Jk4 Gn3 Jk4 Mt4
					18,661	14,127		

REGION - IV

Rainfall Pattern/all-India Zone no (s)	State	District	Taluk	Rain-fall zone no(s) in the State	Geogra-phical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping pattern
E4(C4/C3)E4 105-116,111, 112,099,101, 093,094	Maharashtra	Sholapur	Barsi, Sholapur(N), Sholapur(S), Mohol, Akalkot	IV,V	5028	3967	10.4	Jr1 Jr2 T4 Gn4 Jr3 C4 Pu4 Jr3 C4 Pu4 Jr3 B4 Pu4 O4 Jr3 C4 Pu4 O4 Jr3 B4 O5 W5 Jr3 Gn4 B4 Pu4 Pd4 Jr4 B4 Pu4 O4 Jr4 Pu4 Gn4 W4 Jr4 B4 Pu4 O4 W4 Jr4 Gn4 Pu4 O4 T4 Jr4 Fr4 B4 S4 Jk3 C4 Gn4 Pu4 Jk3 Gn4 Pu4 S4 Jk4 Pu4 Gn4 O4Jr4W5 Jk4 Pu4 B4 Gn4 O4W5
		Osmanabad	Parenda, Osmanabad, Tuljapur, Udgir, Ahmadpur, Bhum, Latur, Ausa, Kallam, Lahore(Umarga) Nilanga				8.2	
		Ahmednagar	Jamkhed				13.0	
		Bhir	Bhir, Ashti, Manjilegaon, Georai Ambejogai, Kaij (roti), Patoda,				7.3	
		Aurangabad	Paithan, Gangapur, Khuldabad, Kannad, Aurangabad, Soegaon				7.8	
		Dhulia	Nandurbar, Sindkheda, Dhulia				10.3	

REGION - IV (contd.)

Rainfall Pattern/all-India Zone no(s)	State	District	Taluk	Rain-fall zone no(s) in the State	Geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping patterns
	Maharashtra	Jalgaon	Chalisgaon, Pachora(½W), Parola, Amalner, Bhadgaon	IV,V			10.1	B3 Jr3 Pd4 B3 Jr4 Pu4 B3 Jr4 Pd4 Pu5 B3 Gn4 C4 Pu4
		Sangali	Shirala(1/3E)				10.5	B3 Pu4 C4 Jr4 W5 B3 Jr4 Pu4 C4 O5
		Poona	Haveli (½E), Poona City				10.7	C3 Pu4 Jk4(B4 Gn4) C4 Pu4 Jk4 B4
		Satara	Wai (½E) Karad(½W), (Satara (1/3E)				13.7	Gn4 Jk4 Jr4 Pd3 Gn4 Jk4 S4
	Madhya Pradesh	Khargane	Barwani, Rajapur	I	421	279	5.6	Jk4 C4 Gn4 Pu4/W4 Jk4 M4 Pu4 C4 Gn4/W4
		Dhar	Manawar				4.8	
	Karnataka	Gulburga	Aland, Gulburga, Afzalpur, Jewargi, Sedam, Chitapur, Chincholi	III	1089	856	2.1	Jr3 O4 T4 Jr3 O4 Gn4 T4/C4/T4 B4 Pu4 T4 Jr4 Gn4 O4/Jk4

REGION - IV (contd)

Rainfall Pattern/all-India Zone no(s)	State	District	Taluk	Rain-fall zone no(s) in the State	Geogra-phical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping patterns
	Rajasthan	Alwar	Behor, Mandawar, Kishangarh, Tijara, Bansur, Thanigazi, Lachhmangarh, Alwar, Rajgarh.	V	1434	1211	15.7	B3 G4W4/Ba4 B3 Pu4 G4 Ba4/F4 B4 Ba4W4Pu4/G4/O4/Gn4 B4W4G4 O4/Ba4/Pu4/Gn4 W4 Jk4 G4 B4 G4W4 B4 Jk4/O4 G4W4 B4 Jk4/Ba4
		Sawai Madhopur	Todabhim, Mahwa, Nadauti				18.7	
		Jaipur	Bassi, Dausa, Baswa, Sikrai				24.8	
		Bharatpur	Weir, Kaman, Nagar, Nadba				25.4	
	Maharashtra	Nasik	Nandgaon, Yeola, Chandor, Baglan, Malegaon, Kalvan($\frac{1}{2}$E)	III	1582	1098	11.7	B1 B2 Pu4 B3 Jr3 B3 Pu4 Gn4 Jr4 B3 Pu4 Gn4 R5
		Ahmednagar	Pathardi, Nevasa, Sheogaon, Kopargaon($\frac{1}{2}$E), Shrirampur($\frac{1}{2}$E)				13.0	

REGION - IV (contd)

Rainfall pattern/ all-India Zone no(s)	State	district	taluk	rain-fall zone no(s) in state	geogra-phical area ((000 ha)	gross cropped area ('000 ha)	district % of G. I. A. to G. C. A.	cropping patterns
	Maharashtra	Dhulia	Sakri	III			10.3	Jr3 B4 05 W5
		Aurangabad	Vaijapur				7.8	Jr3 B4 S4
	Haryana	Mahendragarh	Mohindergarh,		1413	1540	9.3	B3 G3 B3 G4 W4
			Narnaul					W3 Pd4 G4 S4/J4
								W3 Pd4 M4/G4
		Gurgaon	Gurgaon, Rewari,				24.7	W3 G4 B4 S4/J4
			Ballabhgarh,					W3 B4 G4 Ba4
			Palwal, Nuh,					W4 G4 B4 J4 Ba4
			Firozpur Jhirka					
		Karnal	Thanesar, Karnal,				68.2	G4 B4 W4 C4/J4
			Panipat,					
		Rohtak	Sonepat				40.3	

REGION no IV (contd.)

Rainfall pattern all-India zone no(s)	State	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	% of district	cropping patterns
	Uttar Pradesh	Mathura	Mathura, Mat,	I, II	290.4	2585	52.0	W3 Ba4 G4 F5 B4/Jk4
			Chhata, Sadabad					W3 G4 B4 $\frac{\text{Pu4}}{5}$ / C4
		Agra	Keraoli, Kheragarh,				35.1	W3 S4 F4/Pd4 / M4
			Fatehabad, Etmadpur,					W3 S4 M4
			Ferozabad, Agra					W3 B4 M5 Ba5
		Saharanpur	Nakur				41.9	W4 G4 B4 O4
								W4 Pd4 S4 F4/M4
		Muzaffarnagar	Kairana, Budhana				63.0	W4 S4 F4 G4/M4/Pu4
		Meerut	Ghaziabad, Hapur,				65.7	W4 M4 B4 Pu4 Ba4/Pd4/G4
			Bagpath					W4 B4 G4 Pu4/Pd4/M4
		Bulandshahr	Sikandrabad, Khurja,				63.1	B4 W4 G4 O4/T4/Ba4
			Bulandshahr					
		Aligarh	Aligarh (Koil), Khair,				63.6	
			Iglas, Hathras,					
			Sikandra-Rao					
		Mainpuri	Sikohabad				51.0	
							47.7	

REGION-IV (contd.)

Rainfall/ all-Inida Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
( )	Punjab	Ludhiana	Jagaraon, Ludhiana,	IV	763	896	83.0	W3 F4 M4/Pd4/Gn4
			Samrala					W3 F4 Pd4
		Patiala	Fatehgarh Sahib,				80.0	W3 F4 M4 G4 / Pd4
			Nabha, Patiala,					
			Rajpura					
	Andhra Pradesh	Ongole	Giddalore	XI	56821	3144	19.1	Pd2 B4
		Kurnool	Alur, Adoni, Kurnool,				12.7	Pd3 (Jk4 O4)/V4 F4
			Nandyal, Nandikotkur,					Pd4 Jk4 Jr4 O4 Pu4/B4
			Atmakur , Koilkuntla,					Pd4 Jk4 Gn4 Mt4/Jr4
			Allagadda,					
			Banganapalle					
		Mehbubnagar	Achampet, Kollapur,				10.9	Jk3 Pd4 C4 Pu4 / B4
			Alampur, Wanaparthi,					Jk3 Mt4 Gn4 / C4 Pd5/Jr4
			Gadwal, Atmakur,					Jk3 Gn4 O4
			Nagarkurnool, Makthal,					Jk3 Gn4 Mt4 Gn4 Pu4/R4
			Kodangal, Mehbubnagar,					Jk3 Gn4 Pd4 Mt4
			Shadnagar, Kalvakurthi					

REGION - IV (contd)

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area (1000 ha)	gross cropped area (1000 ha)	district % of GIA to GCA	cropping patterns
	Andhra Pradesh (contd.)	Hyderabad	Hyderabad urban,				14.8	Jk4 Pd4 Gn4 Mt4
			Tandur, Hyderabad					Jk4 Pu4 R4 04 Pd4
			East, Chevella,					Jk4 Pd4 Jr4 04 R4/Pu4
			Hyderabad West,					Jk4 Jr4 04 V4
			Ibrahimpatnam.					
			Medchal					
		Nalgonda	Bhongir, Ramannapet,				24.4	Jr3 Gn4 Pd4 Mt4
			Suryapet, Nalgonda,					Jr3 Gn4 Pd4/Mt4
			Devakonda, Miryalguda,					Jr3 Mt4 Gn4 Jk4
			Huzurnagar					Jr3 Pd4 Gn4 Pu4
		Warangal	Jangaon				30.6	Jr4 Pu4 04 T4
								Gn4 Mt4 Jk4 Jr4/Pu4
								03 Jk4 B4
								03 Mt4 Jr4/Gn4 Jk4
								Pu4 Jk4 Jr4 Mt4 G4
								M3 Pd4 Jk4
								Mt3 B4 Pd4 Jk4/Gn4

REGION-IV (contd.)

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Karnataka	Raichur	Raichur, Deodurg, Manvi, Lingsugur ($\frac{1\ E}{3}$)	II	1050	783	10.9	C3 Jr4 Mt4 / Pd5 C4 Jr4 Jk4 Mt4/Gn4/- - Gn4 Pu4 / $\frac{B4}{B4\ Mt4}$ Jr4 Mt4 Gn4 Pu4
		Gulburga	Shorapur, Shahapur, Yadgir				2.1	

REGION - IV (contd)

Rainfall Pattern/ all-India Zone No(s)	State	District	Taluk	Rainfall Zone No(s) in State	Geographical area ('000 ha)	Gross cropped area ('000 ha)	District % of g.c.a. to g.c.a.	Cropping patterns
1.	Gujarat	Bhavnagar	Botad, Palitana, Bhavnagar, Ghogha, Talaja, Mahuwa	VI	1673	1136	8.8	B3 Gn4 Jk4 B3 Gn4 C4
		Mohsana	Vijapur, Visnagar, Kalol Kadi				23.7	B3 W4 O4 F4/Jk4 B3 C4 Jk4 W5 B4 C4 W4 Jk4
		Ahmedabad	Dehgam, Dhandhuka, Dholka, Sanand				12.0	C3 Jk4 W4/Pd4.
		Baroda	Jambugam				13.0	C4 Mt4 Pd4 Jr4 Gn3 B3
		Gandhi-nagar	Gandhinagar				20.4	Jk3 B4 Gn4/W4
		Kheda	Cambay				21.5	W4 B4 C4 Pd4
	Himachal Pradesh	Mahasu	Kumarsain, Kotkhai, Theog	V	91	32	8.0	W3 M4 Pt4 Pt3 W4 M4 Fr4 W4 M4
	Punjab	Jullundur	Nawashahr	V	78	84	81.0	W4 F4 M4

REGION - IV (contd)

Rainfall Pattern/ all India Zone no(s)	State	District	Taluk	Rainfall Zone No(s) in State	Geographical area ('000 ha)	Gross cropped area ('000 ha)	District % of GCA to GCA	Cropping patterns
[illegible]	Uttar Pradesh	Bulandshahr	Anupshahr	III	780	743	63.1	W3 M4 S4 Pu5 W3 B4 M4 Gn4 Pu4/G5
		Budaun	Gunnaur				32.3	
		Aligarh	Atrauli				63.6	W4 M4 B4 Pu4/Pd4/G4
		Etah	Etah				47.7	W4 B4 G4 Pu4/Pd4/M4
		Mainpuri	Jasrana, Mainpuri, Bhongaon, Karhal				51.0	W4 Pd4 B4 G4/M4
093,094	Maharashtra	Parbhani	Gangakhed, Pathri, Basmat, Jintur, Partur, Parbhani, **Hingoli**	VI VII	7815	5334	2.6	Jr3 C4 Pu4 O4
		Aurangabad	**Ambad**, Jalna, Bhokardan, Jaffrabad, Bahardi(Sillod)				7.8	Jr4 C4 Pu4 Pu4 O4 Jr4 Pu4 Gn4 W4 Jk3 C3 Pu4

REGION - IV (contd)

Rainfall pattern all-India Zone no (s)	State	District	Taluk	Rainfall Zone No(s) in State	Geographical area ('000 ha)	Gross cropped area ('000 ha)	District % of GCA to GCA	Cropping patterns
3	Maharashtra (contd)	Dhulia	Shahada, Taloda, Akrani, Shirpur				10.3	Jk3 Mt4 Pu4
		Nanded	Kandhar, Mukhed				4.3	Jk4 Pd4 O4 Mt4
		Buldhana	Chikhli, Mekhar, Malkapur, Khamgaon, Jalgaon				2.4	C2 JK4
		Akola	Washim, Akot, Akola, Balapur, Mangrulpir, Murtazpur.				1.1	C3 Jk3 C3 Pu4 Jk4 C3 Pu4 Jk4 Gn4
		Amravati	Melghat, Amravati, Chandur(½ W), Achalpur, Daryapur, Morshi				1.9	C4 Jr4 Pu4 Jk4 C4 Pu4 Jk4 B4
		Jalgaon	Edlabad, Jalgaon, Chopda, Jamner, Bhusawal, Yaval, Raver, Pachora(½E), Erandol.				10.1	C4 Pu4 Jr4 B4 Pu4 Jk4 C4 B4 B3 Jr4 Pd5 Gn5 B3 Pu4 Gn4 R5
		Yeotmal	Pusad, Darwha				0.9	B4 W4 R4 Pd4 Pu4
		Poona	Junnar, Ambegaon (½ E)				10.7	Pd3 R4 O4 W4
		Nasik	Kalvan (½W) Nasik, Igatpuri (½E) Surgana(½E), Dindori				11.7	R3 Mt4 O4 Pu4 Pd4 W3 R4 Pu4 O4 G5 Fr5

REGION - IV (contd)

Rainfall Pattern all-India Zone no (s)	State	District	Taluk	Rainfall Zone No(s) in State	Geographical (area) ('000 ha)	Gross cropped area ('000 ha)	District % of GIA to GCA	Cropping patterns
	Madhya Pradesh	Khargone	Khargone, Kasrawad, Sendhwa, Bhikangaon, Maheshwar, Barwaha	I	1230	847	5.6	Jk3 C4 B4 Pu4/W4 Jk3 C4 Pu4 F4 Jk3 C4 Pu4/F4
		Khandwa	Burhanpur, Khandwa				4.2	Jk4 C4 Gn4 Pu4/W4 Pu3 Jk4 B5 C5 C3 Jk4/Pu4 C3 Jk4 Pu4 W4
	Karnataka	Bidar	Bidar, Aurad, B.Kalyan, Humnabad, Bhalki	IV	545	407	2.9	Jr3 G4 Pu4 Jk5 Pu4 Mt4 O4 B4 Jr4 Pu4 T4 Jr4 Gn4 O4/J1 Pu4 G4 Jk4 Jr4/Jr5 Gn5

REGION - IV (contd)

Rainfall pattern/ all-India zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Andhra Pradesh	Medak	Zahirabad, Sangareddy, Narayankhed, Andole, Narasapur, Medak, Gajwel, Siddipet	XVI	3556	1745	20.0	Pd3 M4 S4/Jr Pd4 Pu4 Jr4/ Jk4 Pd4 Pu4 M4 Jk4/Jr4
		Hyderabad	Vicarabad, Pargi				14.8	Jk4 Pd4 Jr4 J4 R4 Pu4 Jk4 Pu4 R4 Pd4 J4 Mt4
		Khammam	Khammam				19.4	Jr4 Pu4 Pd4/ Jk4/Gn4 Jr3 C4 Pu4 O4
		Warangal	Mahbubabad, Narsampet, Warangal				30.6	Jr4 Pu4 Jk4 Pd4/T4 Jr4 Pu4 Pu4 G Jr4 Jk4 Pu4 O
		Karimnagar	Huzurabad, Karimnagar, Sirsilla, Jagtial, Sultanabad, Manthani				29.3	M3 Pd4 Pu4 M4 Pd4 Jk4 O4/R4
		Nizamabad	Kamareddy				43.1	Pu4 M4 Jk4 Pd4
		Adilabad	Asifabad, Lakshettipet				6.9	

REGION - V

rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	Geographical area (000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
1	2	3	4	5	6	7	8	9
E4(B1C1E2)E4 104	Rajasthan	Udaipur	Kotra, Kumbhalgarh, Girwa, Gogunda, Mavli, Jhalasia, Nathdwara, Kherwara, Railmagra	VI	1756	446	24.2	M1 M2 Mt5 W5 M2 W4 Ba4/Mt4/G M3 Pd4 W4 G4/Mt M3 W4 04 Mt4/Pu M4 W4 Jk4 Gn4/C
		Sirohi	Pindwara, Sirohi, Reodhar,				22.6	F3 04 M4
		Pali	Desuri, Bali				15.0	04 F4 B4 Pu4/M4 B4 04 Pu4 Mt4/1
	Gujarat	Jamnagar	Bhanvad, Jamjodhpur, Kalavad, Khambhaliya, Lalpur, Jamnagar, Dhrol	V	3691	2504	8.8	Gn1 Gn2 Jk4/B4 Gn2 W4/C4/Jr4 Gn2 B4/C2
		Junagadh	Una, Bhesan, Visavadar, Veraval, Ranavav, Kutiyana, Porbandar				15.8	Gn3 Jk4 B4/C4 Gn3 C4 F4/Jr4

REGION - V (contd.)

1	2	3	4	5	6	7	8	9
	Gujarat (contd.)	Amreli	Kodinar, Rajula, Jafrabad, KunkavaV-Vadia				7.4	Gn4 Jr4 F4 B4 C2 Jk4/B4
		Rajkot	Dhoraji, Jetpur, Jam Kandorna, Gondal, Lodhika, Paddhari, Kotda-Sangani, Upleta,Rajkot, Jasdan, Morvi, Wankaner, Maliya.				11.6	B3 Gn4 Jk4 B3 Gn4 S4 B3 Gn 4(C4Jk4)F4
		Surendra-nagar	Ghotila, Lakhtar, Halvad, Dhrangadhra				5.9	B4 Jk4 W4 04/C4/Gn4 B4 Jk4 W4/F4
		Mehsana	Patan, Sidhpur, Kheralu, Mehsana				23.7	
		Banaskantha	Vadgam				13.2	
		Ahmedabad	Viramgam				12.0	
					5442	2950		

REGION - VI

Rainfall pattern/ all-India Zone no(s)	State	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
E4(B2E2)E4 091	Gujarat	Banaskantha	Deesa, Palanpur, Danta	VII	423	316	13.2	B3Jk4F4/C4 B4Jk4W4/F4
		Sabarkantha	Khedbrahma				12.8	M3C4W5 M4Mt4W4F4B4
	Jammu & Kashmir	Rajauri	Nowshehra	III	113	23	12.5	W3M3
	Rajasthan	Sawai Madhopur	Gangapur, Bamanwas Malarnachor,	VII	2272	1107	18.7	B3C4W4Gn4 B4Ba4W4Pu4/G4/O4/Gn4
		Tonk	Nawai, Tonk, Uniara, Todaraisingh, Deoli				15.4	M3W4Ba4G4/Gn4/C4 M3O4Ba5(Pu4/W4/O4) M4W4Ba4(F4/Jk4)C5
		Jaipur	Lalsot				24.8	M4W4Jk4Gn4/C4
		Bhilwara	Mandalgarh, Banera, Kotri, Bhilwara, Sahara, Shahpura, Jahazpur				44.2	W4Jk4G4B4
		Bundi	Hindoli				40.1	Jk3W4G4/M4/C4/Fu4 Jk4W4G4

REGION - VI (contd)

Rainfall pattern/ all-India zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Rajasthan	Chittaurgarh	Rashmi, Gangrar, Begun				26.3	
		Ajmer	Kekri				23.1	
070	Rajasthan	Sirohi	Abu-Road	XI	90	15	22.6	M3W404Mt4/Pu4
					2898	1461		

REGION - VII

rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to G.C.A	cropping patterns
E4(B2C1E1) E4 036	Rajasthan	Udaipur	Salumber, Sarada, Lasadia, Vallabhnagar	VIII	3662	1776	24.2	M2 W4 Ba4/Mt4/Gn4 M3 Pd4 W4 G4/Mt4
		Dungarpur	Dungarpur, Aspur, Sagwara,				9.5	M4 W4 Jk4 Gn4/C4 M4 Pd4 G4 Mt4 C4/W4
		Banswara	Gahri, Bagidora,				5.4	
		Chittaurgarh	Chittaurgarh, Kapasan, Bhadesar, Nimbhera, Dungla, Bari Sadri, Chboti Sadri, Pratapgarh				26.3	W3 Jk4 G4/O4 W4 G4 B4 O4 B3 G4 W /Ba4 B3 G4 W4 [illegible]4
		Kota	Ladpura, Digod, Pipalda, Ramganjmandi				20.9	B4 W4 G4 O4/Ba4/Fu4/Gn4
		Bundi	Bundi, Nainwa, Keshoraipatan				40.1	Jk3 W4 G4/M4/C4/Pu4 Jk3 B4(G4 W4)/(O4 Pu4)
		Bharatpur	Rupbas, Baseri, Bari, Rajakhera, Dholpur, Beyana, Bharatpur, Deeg				25.4	Jk4 W4 G4 M4 C4 W4 B4 Jk4/O4
		Sawai Madhopur	Hindaun, Karauli, Sapotra, Khandar				18.7	
		Jhalawar	Pachpahar				10.1	

REGION - VII (contd)

Rainfall pattern / all-India Zone no(s)	state	district	taluk	rain-fall zone no(s) in state	geogra-phical (1000 ha)	gross crop-ed area ('000ha)	dist-rict % of g.i.a. to g.c.a.	cropping patterns
	Punjab	Rupar	**Anandpur Sahib,Rupar, Kharar**	VI	734a	645	28.0	W3 F4 M4 W3 Pd4 M4/ F4
		Hoshiarpur	Garhshankar,Balachaur, Hoshiarpur,Dasuya				37.0	W3 F4 M4 G4
		Gurdaspur	Gurdaspur				82.0	W4 M4 F4 G4
	Haryana	Ambala	Ambala,Jagadhri,Kalka, Naraingarh	IV	374	326	22.5	W3 Pd4 M4 G4/S4/F4 W4 Pd4 M4 G4/S4/F4
	Madhya Pradesh	Bhind	Gohad,Mehgaon,Lahar, Bhind	III	4694	2348	13.1	W3 G4 Jk4/Pd4/04 W3 Jk4 G4/04/F4
		Gwalior	Pichhore,Bhander,Gwalior				28.9	W4 Jk4 04 F4/G4
		Datia	Seondha,Datia				8.8	W4 Jk4 04 F4 Mt4 M4/Pu4
		Morena	**Sheopur,Bijaypur,Sabalgarh, Morena,Ambah,Joura**				17.5	
		Shivpuri	Shivpuri,Karera,Pohri, Pichhore,Kolaras				13.6	
		Mandsaur	Bhanpura,Manasa,Garoth Malhargarh,Mandaur, Neemuch,Sitamau,Jawad				10.8	
		Shajapur	Susner				5.4	
		Ratlam	Jaora,Alot				6.5	
	Jammu &K Kashmir	Jammu	Ranbirsinghpora	II	40	54	26.5	Pd3 W3

Rainfall pattern / all-India Zone no(s)	*state	district	taluk	rain-fall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000ha)	district % of G.I.A. to G.C.A.	cropping patterns
	Himachal Pradesh	Mandi	Karsog	VI XIV	330	46	17.0	W3M4Pd4/Ba4/Ba4Pd4
		Kulu	**Banjar,Ani,Nirmand**				5.3	
	Uttar Pradesh	Saharanpur	Deoband,Roorkee,Saharanpur	IV	9639	8594	41.9	W3S4F4/M4/Pd4 W3Pd4S4G4/F4/B4
		Bijnor	Bijnor				30.0	W3M4S4Pd5B4/Gn4 W3B4M4Gn4Pu4/G5
		Muzaffarnagar	Muzaffarnagar,Jansath				63.0	W3M4G5V4/V5B5
		Meerut	Mawana,Sardhana,Meerut				65.7	W3Pd4Gn4/S4
		Moradabad	Moradabad,Amroha,Bilari, Hasanpur,Sambhal				38.6	W4Pd4S4F4/M4 W4S4F4Gn4/M4/Pu4 W4Pd4S4G4
		Rampur	Shahabad				20.0	W4Pd4G4Pu5S5/B5 W4B4G4Gn4Pu5M5
		Budaun	Budaun,Sahaswan,Bisauli, Dataganj				32.3	W4B4M4Pu4 W4B4M4Gn5G5/Pd5Pu5 W4M4Pd4G4
		Barreilly	**Aonla**				31.5	W4M4Pd4Gn4Ba4/G4 W4Gn4G4Ba4M4/Pd4
		Shahjahanpur	**Tilhar,Jalalabad**				26.9	W4B4M4Pd4G4 W4Pd4B4M4
		Etah	**Kasganj,Aliganj**				47.7	W4B4Pd4G4M4/O4/M4Ba4 W4Pd4Ba4G4Jk4/M4/M4B4
		Farrukhabad	Farrukhabad,Kaimganj, Chhibramau,Kannauj				37.8	W4Pd4G4B5S5Jk5 W4Pd4G4S5 W4Pd4M4
		Hardoi	Shahabad,**Hardoi**,Bilgram, Sandila				17.3	Pd3W4G4/Ba4/Pu4 Pd3W4G4Pu5
		Agra	Bah				35.1	Pd3W4Ba4Pu4/G4/M4 Pd3W4Ba4Pu4/Jk4
		Etawah	Etawah,Bharthana,Bidhuna, Auraiya				41.7	Pd4W4Ba4Jk4/Pu4/G4 Pd4W4B4Ba4Pu5/G4
		Jalaun	Konch orai,Jalaun,Kalpi				32.2	Pd4W4Ba4M4

REGION-VII (contd.)

Rainfall pattern/ state all-India zone no(s)	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	% of district SIA to GCA	cropping patterns
Uttar Pradesh (contd.)	Kanpur	Bilhaur, Kanpur, Akbarpur, Derapur, Bhogipur, Ghatampur				30.1	G3 W3 G3 W4 B4/Jk4/T4 G4 W4 Pd4 Ba4 Jk4/B4
	Unnao	Purwa, Unnao, Hasanganj, Safipur				29.4	G4 Pd4 Ba4/B4
	Lucknow	Malihabad, Lucknow, Mohanlalganj				32.6	G4 Jk4 T4 W4/Ba4 S3 W4 F4
	Barabanki	Fatehpur, Haidargarh				27.8	B4 G4 T4
	Sitapur	Biswan, Sidhauli				16.7	Ba4 Pd4 W4 B4 G4
	Sultanpur	Musafirkhana, Amethi Sultanpur				30.1	
	Faizabad	Akbarpur				42.5	
	Rae Bareli	Salon, Rae Bareli, Palmau				36.4	
	Fatehpur	Fatehpur, Khaga, Lindki				26.3	
	Hamirpur	Maudaha, Mahoba, Charkhari, Rath, Hamirpur				15.4	
	Jhansi	Garautha, Mauranipur, Jhansi				18.7	
	Allahabad	Allahabad, Sirathu, Manjhanpur, Phulpur, Soraon Karchhana				23.1	
	Banda	Mau				16.2	
	Jaunpur	Machhlishahr, Mariahu, Shahganj				43.1	
				19473	13789		

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rain-fall zone no(s) in state	Geographical area ('000 ha)	Gross-cropped area (000 ha)	district % of GIA to GCA	Cropping pattern
E4(B2C2)E4	Andhra Pradesh	Khammam	Yellandu, Bhoorgampadu, Bhadrachalam, Kothagudem, Madhira.	XVIII	1649	531	19.4	Pd3 M4 Pu4 Jr3 Pu4 Pd4
[illegible]-CB2		Karimnagar	Metpalle				29.3	Jr3 Pu4 Pd4 /JK4 /Gn4
		Nizamabad	Armoor				43.1	Pu4 M4 JK4 Pd4
		Krishna	Tiruvur				60.2	
	Gujarat	Panchmahals	Shehera, Limkheda, Dodah, Jhalod, Lunavada.	VIII	505	306	3.1	C3 Jr4 Pd4 To4/Mt4/ M3 Pd4 Gn4 Mt4/B4
		Baroda	Savli				13.0	M4 Pd4 Gn4 G4 M4 Pd4 Gn4 Mt4/B4 B4 M4 Pd4 R4
	Maharashtra	Nanded	Hadgaon, Bhokar, [illegible] Nanded, Biloli, Deglur.	VIII	720	560	4.3	C3 JK3 C4 Jr4 Pu4 JK4
		Parbhani	Kalamnuri				2.6	JK3 C4 Pu4 [illegible] JK4 C4 Pu4 Jr4 Gn5 05

REGION - VIII (contd.)

Rainfall pattern/ all-India zone no(s)	State	District	Taluk	Rain-fall zone no(s) in State	Geographical area ('000 ha)	Gross Cropped area (000 ha)	District % of GIA to GCA	Cropping patterns
	Madhya Pradesh	Indore	Indore, Depalpur Sawer, Mhow	IV	2595	1712	5.9	W3 Jk4 G4 F4/Pu4 W4 JK4 G4 F4 C4 M3 JK4 Pd5 C5
		Ujjain	Badnagar, Khacharod Mahidpur, Tarana, Ujjain				2.9	M4 JK4 Mt4 C4 F4 Jk3 W4 F4 C4/G4 JK4 Pu4 M4 Gn4 C4 JK4 F4 W4 G4/C4 F4 JK4 W4 G4
		Ratlam	Ratlam, Saliana				6.5	C4 Pu4 M4 Gn4 F4
		Dhar	Dhar, Badnawar, Mukshi, Sardarpur				4.8	Mt4 Pu4 JK4 B4/M4
		Jhabua	Jhabua, Thandla, Petlawad, Alirajpur, Jobat				2.2	
		Dewas	Dewas				2.6	
	Uttar Pradesh	Azamgarh	Ghosi, Sagri Mohammadabad	V	1,050	974	42.6	Pd3 Ba4 Pu4 Pd3 Ba4 Pu4 W4/T4
		Lakhimpur	Lakhimpur, Mahamdi				9.8	Pd4 W4 S4 M4/G4 Pd4 W4 Ba4 G4
		Sitapur	Sitapur, Misrikh				16.7	W4 Pd4 G4 S4/Ba4 Gn4
		Ghazipur	Zamania				33.0	

Rainfall pattern / all-India Zone no(s)	state	District	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
	Bihar	Patna	Bihar Barh	I II X	1384	1179	51.0	Pd2 Pu4
		Saran	Chapra				21.1	Pd3 W4
		Bhagalpur	Bhagalpur, Banka				37.5	Pd4 M4 W4 Ba4
		Santhal Parganas	Godda				8.8	Pd4 M4 W4 Pu4 Pu3 Pd4 W4
					7904	5262		

cropping patterns

4 G4 Pu4

G4/3a4/Pu4
4Pu4W4 S4/5

4Pu4
3a4Pu4/G4

4W4Pu5B4/

Ba4Pu4/G4
Ba4G4M4

Pd4W4

d43a4M4/

4/W4/M4/

4/W4/M4/
4
4W4

REGION - IX

Rainfall pattern all-India Zone no(s)	State	district	taluk	rai zo in
E4 (A1 B2 C1) E4 056	Uttar Pradesh	Barabanki	Nawabganj, Ramsanehighat	
		Faizabad	Faizabad, Bikapur, Tanda	
		Azamgarh	Phulpur, Azamgarh, Lalganj	
		Jaunpur	Jaunpur, Kerakat	
		Ghazipur	Saidpur, Ghazipur, Mohammadabad	
		Ballia	Ballia	
		Basti	Harraiya	
		Sultanpur	Kadipur	
	Bihar	Gaya	Jahnabad	
		Saran	Gopalganj	

REGION - IX (contd)

Rainfall pattern/ all-India Zone no(s)	State	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	% of GIA to GCA	district cropping patterns
	Bihar	Monghyr	Begusarai,				24.4	Pd4M4W4S4/Ba
		Shahabad	Buxar				60.5	M3W4Pd4
		Patna	Patna, Sadar Patna City Dinapur				51.0	
		Darbhanga	Madhubani				9.3	
076	Uttar Pradesh	Ballia	Rasra, Bansdih	VI VII	462	487	32.9	W4 Pd3Ba4Pu4/S5/
		Deoria	Salempur, Deoria				37.7	Pd4W4Ba4Mt4 Pd4W4Ba4M4G4
	Andhra Pradesh	Nizamabad	Madnur, Banswada, Yellareddy, Nizamabad, Bodhan	XIX	494	218	43.1	Pd2M4 Pd3Jr4Jk4/S Jr4Pu4Jk4Gm
					4536	4007		

REGION - X Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	croppin pattern
E4 (A_1C_3)E4	Gujarat	Junagadh	Manavadar, Keshod, Malia Talala, Mendarda, Vanthali, Junagadh, Mangrol	IX	984	616	15.8	Gn1 Gn2 W4/C4/ Jr4
071								
		Surat	Ghorasi, Olpad				12.7	Gn3 Jk4 F4
		Bharuch	Amod, Jambusar, Vagra, Bharuch, Hansot, Anklesvar				9.0	Jk3 C4 Gn4 Pd4/Fr4 C1 C2 Jr4 C2 Jk4 C3 Jk4 C3 Jr4 Jk4
					984	616		

REGION -XI

Rainfall pattern/ All-India zone no(s)	state	district	taluk	rain-fall zone no.(s) in State	Geographical area ('000ha)	Gross cropped area ('000 ha)	dis-trict %of GIA to GCA	Cropping patterns
E4 (A1B1C1E1)E4	Rajasthan	Kota	Mangrol, Baran, Sangod, Shahbad	IX	426	223	20.9	W3 JK4 G4/O4 JK3 W4 G4/M4/L4/Pd4
A-061								
	Himachal Pradesh	Kangra	Amb, Una	II, III	388	165	21.6	W3 M3
		Bilaspur	Bilaspur Sadar, Ghamarwin,				7.3	M3 W3
		Simla	Nalagarh				15.4	M3 W4 G4
		Mahasu	Arki, Solan, Suni				8.0	
	Gujarat	Kheda	Mehmudabad, Nadiad(Kheda) Kapadvanj.	X	956	714	21.5	M2 Pd4 M4 C4 Pd4 Gn4 B4/W4
		Sabar-kantha	Vijayanagar, Bhiloda, Meghraj Prantij.., Himatnagar.				12.8	B3 Pd4 Mt5 To4/W4 B4 JK4 Pd4 F4/W4
			Modasa, Malpur, Bayad, Idar					Gn3 B4 C4 Gn4 B4 C4 M4/Pd4
		Ahmedabad	Ahmedabad, Daskroi				12.0	C4 Gn4 M4 B5

REGION-IX (contd.)

ainfall attern/ ll-India one no(s)	State	District	Taluk	Rainfall zone no(s) in the State	Geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping Patterns
	Madhya Pradesh	Shajapur	Shajapur, Agar	V	918	532	5.4	JK3 C4 G4/W5 JK3 F4 C4 M4/W4
		Rajgarh	Rajgarh, Khilchipur, Sarangpur				4.5	W3 JK4 G4/F4/O4
		Guna	Mongaoli				2.9	
	Utter Pradesh	Jhansi	Jhansi, Lalitpur, Mahrcni	VIII	971	569	18.7	W3 M4 JK4 G4 Pu4 W3 JK4 Mt4 Pd3 W4 Ba4 Pu4 Pd4 W4 Ba4 Pu4 B4 G4
		Paratapgarh	Pratapgarh, Kunda, Patti				32.0	
					3661	2203		

REGION - XII

Rainfall Pattern all-India Zone no(s)	State	District	Talul	Rainfall zone no(s) in the State	Geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping Patterns
E4(A1B1C2)E4 064	Andhra Pradesh	Warrangal	Parkal, Mulug	XX	1271	471	30.6	Pd2 Jr4
		Adilabad	Adilabad, Boath, Mudhol, Utnur Khanapur, Nirmal				6.9	Pd3 M4 Pu4 Pd4 Pu4 Jr4/Jk4 Jk3 C4 04/Pu4 Jk4 C4 Pu4 Pd4/05
	Gujarat	Kheda	Matar, Borsad, Petlad, Thasra, Balasinor, Anand	XI	1595	1051	21.5	C1 C2 Jr4 C3 Jr4 Jk4 C3 Jr4 Pd4
		Panchamahals	Santarampur, Godhra, Kahal, Halal, Devgarbharia				3.1	C3 Jr4 Pd4 To4/Mt4/(B4To4) C4B4Pd4M4/To4 C4Pd4Mt4Gn4/Jr4 C4Pd4Jk4Mt4 M3Pd4Gn4/Mt4G4
		Bharuch	Sagbara, Jhagadia, Valia, Narded (Rajpipla), Dediapada				9.0	M4Pd4Gn4Mt4/B4 Pd3W4B4C4 B3Pd4Mt5To4/W4 To3 B4 Pd4
		Surat	Mangrol				12.7	Jk3 C4 Gn4 Pd4/Jr4 Gn4 Pd4 B4 C4
		Baroda	Sinor, Dabhai, Karjan, Waghodia, Vadodara, Padra				13.0	Jr4 Pd4 C4 Mt4

REGION - XII (Contd)

Rainfall Pattern/ all-India Zone no(s)	State	District	Taluk	Rainfall Zone no(s) in the State	Geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping Patterns
	Maharashtra	Amravati	Chandur (½E), Morsi (½E)	X,XI	3072	1919	1.9	C2Jk4 C3 Jk3 C3 Jk3 T5 Jk3 C4 T5 Jk4 C4 Pu4 Jr4 O4 Jr1 W4 O4 Pd4 O5/Jk4 Mt3 Pu4 C4 Jr4 Gn4
		Yeotmal	Pandharkawara (Kelapur), Wani, Yeotmal				0.9	
		Nanded	Kinwat				4.3	
		Wardha	Wardha, Arvi, Hinganghat				2.1	
		Nagpur	Katol, Nagpur, Seoner, Ramtek, Umrer (⅓ W)				6.3	
		Chanda	Rajura, Warora,				15.6	
		Dhulia	Narapur				10.3	

REGION - XII (contd)

pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Madhya Pradesh	Durg	Khairgarh, Kawardha	VI VII	3268	1904	9.8	Jk3 C3
		Dewas	Kannod, Bagli, Sonkach, Khategaon				2.6	Jk3 Gn4 T4
		Chhindwara	Sausar, Chhindwara, Amarwara				4.2	Jk4 Mt4 W4 O4 G4 Jk4 W4 Mt4 Pu4 G4 / T4
		Betul	Multai, Bhainsdehi Betul				6.8	Jk4 F4 W4 G4 / C4 W3 O4 C4 / Pu4
		Sehore	Ashta				3.6	W3 Jk4 F4/C4/O4/G4
		Hoshangabad	Harda				1.9	Mt3 W4 G4 Jk4
		Khandwa	Harsud				4.2	C4 Jk4 Pd4 Mt4 Pd3 Mt4 Pu4 / G4
	Uttar Pradesh	Bareilly	Bareilly, Faridpur	IX	573	970	31.5	W4 Pd4 S4 G4/[illegible] G4
		Shahjahanpur	Powayan, Shahjahanpur				26.9	W4 Pd4 G4 Pu5 S4/B5
		Rampur	Rampur, Milak, Suar				20.0	W4 Pd4 M4 G4/S4

REGION - XII (contd)

pattern/ all-India Zone no (s)	state	district	taluk	rainfall zone no(s) in state	geogra-phical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Bihar	Gaya	Nawada	III IV XI	707	525	65.0	Pd1
		Muzaffar-pur	Hajipur				4.7	Pd2 Pu4
		Santhal Parganas	Deogarh				8.8	Pd4 M4 W4 Pu4
					10486	6440		

REGION - XIII

Rainfall/pattern/ all-India Zone no(s)	state	district	taluk	rain-fall zone no.(s) in state	Geographical area (000 ha)	Gross Cropped area (000 ha)	district % of GIA to GGA.	Cropping patterns
E4(A2C1E1)E4	Jammu & Kashmir	Jammu	Akhnoor, Jammu, Samba	IV	55	201	26.5	(W3 M4 Pd4 B[illegible] (
ZA - 050		Kathua	Billawar, Basholli, Kathua, Hiranagar				5.3	(M3 W4 B[illegible]4/Pu4/Mt4/Pd4 (Pd3 M4 W4/C4/V4 (
	Madhya Pradesh	Kangra	Nurpur, Deragopipur Hamirpur, Badsar,	VII	482	198	21.6	W3 M3 W3 M4 Pd4
	Rajasthan	Kota	Kishanganj, Atru, Chhabra, Chhipabarod	X	145[illegible]	700	20.9	(JK3 C4 M4 B4/W4 (JK3 W4 G4/M4/C4/Pu4
		Jhalawar	Khanpur, Jhalrapatan, Aklera, Pirawa, Gangadhar				10.1	(JK3 B4(G4 W4)/(O4 Pu4) ((
		Sawai Madhopur	Sawai Madhopur				18.7	(M3 Pd4 W4 G4/Mt4 ((
		Banswara	Ghatol, Banswara, Kushalgarh				5.4	(M4 W4 JK4 Gn4/C4 (M4 Pd4 G4 Mt4 C4/W4 ((

REGION - XIII (contd)

Rainfall pattern All-India zone no(s)	state	district	taluk	rain-fall Zone no(s) in State	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
	Uttar Pradesh	Banda	Banda, Baberu, Naraini, Karwi	XI	1814	1437	16.2	G3 W4 G3 W4 Pd4
		Allahabad	Handia, Meja				23.1	G3 W4 JK4 T4/Pd4
		Varanasi	Gyanpur, Varanasi, Chandauli, Chakia				39.9	Pd3 W4 G5 Pd3 W4 G5 Ba4/Pu4/Mt4
		Mirzapur	Mirzapur, Chunar				22.2	Pd4 W4 G4 Pd4 Ba4 W4 Pu5 S5 B5 Pd4 W4 Ba4 B4 G4/Pu4/5
	Madhya Pradesh	Chhatarpur	Laundi, Chhatarpur, Bijawar	VIII	2473	1258	17.7	W3 JK4 G4 W3 Pd4 O4
		Panna	Panna, Ajaigarh				3.4	W4 Mt4 F4 JK4/Pd4
		Satna	Nagod				1.6	W4 Mt4 F4 O4 Ba4 W4 M4 Mt4 G4/O4
		Tikamgarh	Tikamgarh, Jatara, Niwari				28.2	
		Rewa	Sirmaur, Huzur, Manganj, Teonthar				1.0	Pd3 Mt4 W4/O4 Pd4 G4 W4 JK4 Ba4 G4 W4 O4 Ba4
	Punjab	Gurdaspur	Pathankot	VII	94	68	82.0	W3 Pd4 M4/F4
				-	6874	3862		

REGION - XIV

Rainfall Pattern all-India Zone no(s)	State	District	Taluk	Rainfall zone no(s) in the State	Geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping Patterns
E4(A2C2)E4	Madhya Pradesh	Sagar	Khurai, Sagar, Banda, Rehli.	IX,X	8512	5043	1.8	Pd1 Pd3 Mt3 Pu4/G4 Pd3 Mt4 O4 Pd3 W4 G4/Mt4/O4 W2 G4/F4 W3 F4 Pu4 W3 Pd4 G4 W3 Pu4 G4 W3 Jk4 F4/C4/G4/O4 W3 O4 Pu4 G4 W4 Pd4 Mt4 G4/O4 Jk3 W4 F4/G4 Jk3 C4 Gn4 Pu4 W4 G4 Jk4 Mt3 Pl4 O4 G4 W4 Pu4 Jk4
046		Raisen	Raisen Gahaiart Ganj Baraily, Silwani, Begamganj, Udaipura, Goharganj				1.1	
		Vidisha	Vidisha, Basoda, Kurwai, Sirong, Latori				0.4	
		Damoh	Damoh, Hatta				4.3	
		Sehore	Budni, Huzur, Sehore, Ichhawar, Berasia, Nasrullaganj					
		Guna	Guna, Ashoknagar, Raghogarh, Chachaura				2.9	

REGION -XIV (contd.)

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state.	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropp patte
	Madhya Pradesh	Satna	Maihar, Amarpatan, Raghorajnagar				1.6	
		Rajgarh	Biaora, Narsinghgarh				4.5	
		Shajapur	Sujalpur				5.4	
		Shahdol	Beohari, Bandhugarh				0.7	
		Panna	Pawai				3.4	
		Jabalpur	Murwara, Patan				3.9	
		Bilaspur	Janjgir, Bilaspur, Mungaoli				13.2	
		Raipur	Baloda Bazar				18.5	
		Surguja	Baikunthpur, Manendragarh				0.9	
		Durg	Bemetra				9.8	

REGION - XIV"(contd)

ifall ttern/ -India e no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Uttar Pradesh	Mirzapur	Robertsganj Dudhi	XII	637	401	33.2	Pd3 [illegible]4 G5 Pu4/Mt4
		Bijnor	Dhampur				[illegible]	[illegible]4 [illegible]4 S4/G4
		Moradabad	Thakurdwara				[illegible]	[illegible] Pd4 [illegible]
	Himachal Pradesh	Simla	Kandaghat, Simla	VIII, IX	305	39	15.4	M3 M3
		Mahasu	Kasumpti				8.0	M3 M3
		Mandi	Mandi Sadar, Chichot, Sundarnagar.				17.0	WO M4 Pd4/- Sa4/Ba4 Pd4
					9454	5533		

REGION - XV

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Grass Cropped area ('000 ha)	district % of GIA to GCA	cropping pattern
E4(A2B1C1)E4 -036	Maharashtra	Kolaba	Poladpur(½E), Mahad(1/3E)	XII	992	305	2.0	Pd2R4
		Poona	Mawal(½W), Mulshi(½W), Velhe, Bhor(½W)				10.7	Pd3Jr3 Pd3R4Jr4Mt4 Pd3R4Mt4S4
		Kolhapur	Sahuwadi, Bhudargad, Radhanagari (½E), Ajra, Panhala				13.5	Pd3Gn4Jk4S4 Pd3R3W4Jr5
		Sangli	Shirala(½W)				10.5	Pd4Gn4 Jk4Jr4R4
		Satara	Mahabaleshwar, Patan, Wai(½W), Jaoli, Satara(1/3W)				13.7	Jr3 Pd4Pu4Gn4 Jr3Gn4B4Pu4Pd4
		Dhulia	Akalkuwa				10.3	Mt3Pu3G4Jr4Gn4 Gn4Jk4Jr4
	Himachal Pradesh	Mandi	Jogindernagar Sarkaghat	X	127	55	17.0	W3M3 W3M4Pd4/Ba4/Ba4Pd
	West Bengal	Bankura		I	1314	729	37.5	Pd1
		Purulia					28.3	

REGION - XV (contd)

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Madhya Pradesh	Sidhi	Gopadbanas, Deosar, Singrauli	XI,XII	5142	2536	0.4	Pd2Pu4/Mt4
		Jabalpur	Sihora, Jabalpur				3.9	Pd3Mt4/Pu4 Pd3Mt4Pu4W4
		Hoshangabad	Seoni-Malwa, Sohagpur, Hoshangabad				1.9	Pd3Mt4W4/04 Pd3W4G4/Mt4/0
		Narsimhapur	Gadarwara, Narsimhapur				3.3	Mt3Pd404 Mt3Pd404Ba4
		Shahdol	Sohagpur, Pushparajgarh				0.7	W304C4/Pu4
		Balaghat	Baihar				27.9	W4Mt4Pd4G404
		Surguja	Bharatpur				0.9	Pu4W4G4Jk4
		Mandla	Mandla, Niwas, Dindori				0.6	G4W4Pu4Jk4
		Seoni	Seoni, Lakhnadon				6.6	
	Gujarat	Vadodara	Sankheda, Tilakwada, Nas_vadi, Chhota-udaipur	XII	766	450	13.0	C2Jr4 C3Jr3Pd4
		Panch Mahals	Jambughoda				3.1	C4Mt4Pd4Jr4/ (Gn4M4)

REGION - XV (contd)

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
		Surat Gujarat (contd)	Songadh, Vyara, Palsana, Mahuva, Valod, Mandvi, Nizhar, Uchhal, Kamrej, Bardoli				12.7	C4Pd4Mt4Gn4/J C4Jk4Pd4Fr4/ Pd4Jk4Gn4C4P Jr2Gn2W4 Jr4Pd4Mt4C4 Jk3C4Gn4Pd4/ Jk4Pd4Gn4/Fr
	Bihar	Gaya	Gaya, Aurangabad	VII, VIII, XIII	6600	3630	65.0	Pd1
		Saran	Siwan				21.1	Pd2W4/Pu4/M
		Shahabad	Arrah, Sasaram, Bhabua				60.5	Pd3W4
		Palamau	Garhwa, Daltonganj, Latehar				23.1	Pd3Pu4W4/M4 Pd3M4Pu404
		Hazaribagh	Chatra, Hazaribagh, Giridih				6.8	Pd4M4W4Pu4/
		Ranchi	Simdega				2.8	M3W4Pd4
		Dhanbad	Dhanbad, Baghmara				4.1	
		Muzaffarpur	Muzaffarpur				4.7	
		Darbhanga	Darbhanga, Samastipur				9.3	
		Saharsa	Saharsa				12.9	

REGION XV (contd)

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Uttar Pradesh	Dehradun	Dehradun	XIII, XIV	4004	4147	30.9	Pd2W4
		Lakhimpur	Nighasan				9.8	Pd3W4S4/G4/M4 Pd3W4Mt4/Ba4
		Bijnor	Najibabad, Nagina				30.0	Pd3W4Ba4/Pu4 Pd3W4M4Pu4
		Bahraich	Nanpara, Bahraich, Kaiserganj				7.7	Pd3W4M4/Pu4 Pd4W4S4 Pd4W4Ba4Mt4
		Nainital	Kashipur, Khatima, Kichha				30.3	Pd4W4M4S4
		Bareilly	Baheri, Nawabganj				31.5	W3Pd4S4 W4Pd4S4M4/F4/Pu4
		Pilibhit	Pilibhit, Bisalpur Puranpur				25.7	M3W4Pd4 M4W4Pd4
		Rampur	Bilaspur				20.0	
		Gonda	Gonda, Utraula, Bal-rampur, Tarabganj				20.6	

REGION XV (contd)

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
		Basti	Basti, Bansi, Khalilabad, Damariaganj, Naugarh				37.9	
		Gorakhpur	Maharajganj, Pharenda, Gorakhpur, Bansgaon				31.6	
		Deoria	Hata, Padrauna				37.7	
	Andhra Pradesh	Adilabad	Sirpur, Chinnur	XXI	4000	113	6.9	Jr3Pu404 Jr3Pu4Pd4
					19345	11985		

REGION - XVI

Rainfall Pattern/ all-India Zond no(s)	State	District	Taluk	Rainfall Zone No(s) in State	Geographical area ('000 ha)	Gross cropped area ('000 ha)	District % of GIA to GCA	Cropping patterns
E4(A2B2)E4	Andhra Pradesh	Khammam	Nugur	Special II	162	21	19.4	Pd2 Jr4
029								
	Gujarat	Valsad	Gandevi, Chikhli, Bansda, Navsari	XIII	219	110	7.5	Pd3 Pu4 JK4 Pd3 R4 Pu4/Jk4 Jk4 C4 Pd4 Pu4
	Madhya Pradesh	Raigarh	Raigarh, Sarangarh, Jaspur, Udaipur, Gharghoda	XIII	7529	3858	3.2	Pd1 Pd2 Mt4/Pu4
		Bilaspur	Sakti, Katghora				13.2	Pd3 Mt3
		Raipur	Mahasamund, Bindranawagarh, Raipur Dhamtari				18.5	Pd3 Mt4 O4
		Bastar	Bijapur, Kanker, Bhanupratappur, Narayanpur, Jagdalpur, Konta, Kondagaon, Dantewara				1.8	Pd3 Mt4 Pu4 / G4 Mt3 Pd4 O4

REGION - XVI (contd)

infall ttern/ l-India ne no(s)	State	District	Taluk	Rainfall Zone No(s) in State	Geographical area ('000 ha)	Gross cropped area ('000 ha)	District % of GIA to GCA	Cropping patterns
		Surguja	Surajpur, Ambikapur, Samri, Pal				0.9	
		Balaghat	Wara-seoni, Balaghat				27.9	
		Durg	Durg, Sanjeri Balod, Rajnandgaon				9.8	
	Bihar	Ranchi	Gumla, Khunti, Ranchi	IX XIV	5899	3439	2.8	Pd1
		Singhbhum	Chaibasa, Seraikela, Jamshedpur				6.4	Pd2 Pu4/W4/M4/Mt4
		Santal Parganas	Sahibganj, Dumka, Jamtara				8.8	Pd3 Pu3 W4
		Champaran	Bettiah, Motihari				20.2	
		Muzaffarpur	Sitamarhi				4.7	
		Saharsa	Supaul, Madhepura				12.9	
		Purnea	Purnea, Katihar				8.6	

REGION-XVI (contd.)

Rainfall pattern all-India Zone no(s)	State	District	Taluk	Rainfall Zone No.(s) in State	Geographical area ('000 ha)	Gross cropped area ('000 ha)	District % of GIA to GCA	Cropping patterns
	Orissa	Sundergarh	Sundergarh, Rajgangpur, Hemgir, Panposh, Bonai.	I VII	8526	2848	5.9	Pd1
		Sambalpur	Sambalpur, Jharsuguda, Bargarh, Padampur, Rairakhol, Deogarh, Kuchinda.				18.7	Pd2 Pu4 Pd2 M4
		Dhenkanal	Athmalik, Angul, Talcher, Pallahara, Dhenkanal, Kamakhanagar.				10.0	Pd2 04
		Phulbani (Baudh Khondmals)	Baudh, Khondmals, Baliguda				15.6	Pd3 Pu4 05 Mt5
		Bolangir	Bolangir, Sonepur, Birmaharajpur, Patnagarh, Titlagarh				15.4	Pd3 04 Mt4 M4 Pd4 04 R4 Pu4
		Kalahandi	Kalahandi, Dharamgarh, Jaipatna, Nawapara				5.7	Pd4 04 R4 Mt4. Pu5 R4 04 Pd4 Mt4/T4
		Keonjhar	Barbil, Keonjhar, Champua, Kanjipani.				3.7	

REGION - XVI (contd)

Rainfall Pattern all-India Zone no (s)	State	District	Taluk	Rainfall Zone No(s) in State	Geographical area ('000 ha)	Gross cropped area ('000 ha)	District % of GIA to GCA	Cropping patterns
	Orissa	Koraput	Koraput, Nandapur, (Potangi), Borigama, Kotpad, Nowrangapur, Umarkot, Kashipur.				3.4	
	Maharashtra.	Bhandara	Sakoli, Gondia, Bhandara	XIII	3129	1026	26.8	Pd2 Pu4
		Chandrapur	Brahmpuri, Chandrapur, Sironcha, Gadchiroli				15.6	Pd2 Jr4
		Nagpur	Umrer (½E)				6.3	Pd3 Jr4 Pu4 Jr4 W4 04 Pd4 /JK4
					25464	11302		

REGION - XVII

Rainfall pattern/ all-India Zone no (s)	state	district	taluk	rainfall zone no (s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
E4(A3B1)E4 015	Gujarat	Valsad	Ambergaon, Pardi, Valsad, Dharampur	XIV	463	145	7.5	Pd1 Pd2Fr4
		Dangs					0.2	Pd3R4Pu4, Jk4 R3Mt404Pd4
	Maharashtra	Thana	Bassein, Palghar, Dahanu, Talsari, Jawhar	XV	508	133	1.2	Pd1 Pd3R4Mt4 R3Mt404 Pu4Pd4
		Nasik	Peint, Surgane				11.7	
					969	283		

REGION - XVIII

Rainfall pattern all-India Zone no.(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	Cropping pattern
E4 (E4) C1E3 ZE - 174	Karnataka	Chitradurga	Hiriyur, Challakere	V	376	134	18.5	C4Mt4Jr4Jk4Pu4 Pu4Jk4Mt4B4/Gn4/R4G
	Himachal Pradesh	Kinnaur	Hangrang, Pooh Morang, Kalpa	XIII	7	5	55.0	Ba3 Mt4 W4 Mt3 Ba4
					383	139		

REGION - XIX

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
E1(E4)C2E2 170,171	Tamil Nadu	Ramanathapuram	Aruppukkottai, Paramakudi, Mudukalathur, Tiruvadanai, Sathur, Srivilliputtar	VIII, X, XI XV, XVI, XVII	3919	2105	38.0	Pd1 Pd2 R4
		Tirunelveli	Kovilpatti, Vilathikulam, Sankaranayanarkoil, Tuticorin, Srivaikuntam				41.4	Pd3B4Mt4C4/L4 Pd3Gn4Jk4Pu4/Jr4 Pd3C4B4
		Coimbatore	Udumalpet, coimbatore, Dharapuram, Palladam, Gopichettipalayam, Bhavani, Erode, Avanashi				37.8	Pd4B4Gn4Jk4R4 Pd4Gn4Jk4B4 Pd4B4C4Gn4Mt4 Pd4Jk4Mt4Gn4Bn4 C3B3Mt4/F4/Pd4
		Madurai	Utharapalayam, Palani, Kodaikanal, Vedasandur, Dindigul, Nilakottai, Usilampatti, Tirumangalam, Periyakulam				37.5	C4Mt4B4Pd4F4 C4Jk4Pd4Pu4Mt4 C4Mt4Pd4Gn4/F4 Jk3C3 Jk3C4Pu4Gn4 Jk3Gn4Mt4Pd4
		Tiruchirapally	Karur				36.0	JK4Gn4Mt4Pd4Jr4 Jr3Pu4Mt4Pd4 Pu4Jr4Pd4B4/Mt4 B4Jk4Mt4Gn4Jr4 B3C4Mt4 B3C4Jk4 Fr3L4Pt4
					3919	2105		

REGION - XX

Rainfall Pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
E4(E4) B1C2E1 ZE - 172	Tamil Nadu	Tirunelveli	Tiruchendur, Nanguneri Tirunelveli, Ambasamudram.	VI	566	192	41.4	Pd1 Pd3Pu4Gn5Os4/Fr5 Pd3Mt4B1C4/L4
		Ramanatha-puram	Ramanathapuram				38.0	
					566	192		

GION-XXI

Rainfall pattern/ all-India zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
E1(B1)B2C1E1 ZE - 156	Andhra Pradesh	Nellore	Venkatagiri, Rapur, Atmakur, Nellore Gudur	I	680	225	66.6	Pd1 Pd2Jr4/B1 Pd3Jr1Pu1/Mt4 Jr3Pu4Pd1
					680	225		

REGION - XXII

Rainfall pattern all-India zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	Cropping pattern
E4(E4)A1B2E1 -160	Tamil Nadu	Tanjore	Nagapattinam Thiruthuraipundi	III	191	127	76.0	Pd1
					191	127		

REGION - XXIII

Rainfall pattern/ all-india zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
34(C1E3) C1E3 - 143, 148	Andhra Pradesh	Anantapur	Anantapur, Dharmavaram, Madakasira, Hindupur, Penukanda, Kadiri	XXIII	1126	412	15.4	Gn2 B4 Gn3Pd4Pu4Mt4/R4B4 Mt4Gn4Pu4R4Jk4
	Karnataka	Chitradurga	Davanagere, Harihar, Jagalur, Molakalmuru (½S), Chitradurga, Holalkere, Hosadurga	XII	2406	1139	18.5	L3 Pd3 R2Pu4/Pd4/Pu4Pd4/Pu4Pd5/Pu4M4
		Shimoga	Honnali(½E), Channagiri(½E)				51.3	R3Pu4Pd4/L4 R3Gn4Pd4/Mt4/Pu4/Pu4Pd4
		Kolar	Kolar, Malur, Bangarpet				26.0	R4L4Pu4Mt4/Jk4/Pd4/Mt4Jk4
			Srinivaspur, Mulbagal,					C3Jk4Mt4
			Chintamani, Bagepalli					Gn3 B4 R4

REGION - XXIII (contd)

ll n/ ia (s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Karnataka (contd)	Bangalore	Hoskote				17.3	Pd4R4Jk4Gn4/Pu4
		Tumkur	C.N. Halli, Sira, Koratagere (½N),				16.3	Jk4Mt4B4Gn4/C4/C4Pu4
			Madhugiri, Pavagada					Mt4R4Jk4Pu4
		Chikmagalur	Kadur, Tarikere, Chikmagalur (½E)				12.5	Pu4Jk4Mt4B4/Gn4/R4Gn4
		Dharwar	Ranibennur				5.3	
					3532	1551		

REGION - XXIV

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000ha)	gross cropped area	district % of GIA to GCA	cropping patterns
E4$(C_1E_3)C_2E_2$	Tamil Nadu	Tiruchirappali	Lalgudi, Musiri, Thuraiyur, Kulithali, Tiruchirappalli, Manaparai	XII Spl.VI Spl.IX	854	554	36.0	Pd1 Pd3 Gn3 Pd3 Jk4 B4 Jr4/O4
Z 138, 141, 145, 152,146		Coimbatore	Pollachi				37.8	Pd4 B4 Jr4 Gn4 Mt4
		Kanyakumari	Agasteeswaram				53.2	Jk4 Pd4 Mt4 O4 C4 Gn4 Gn3 Jk4 Mt4 Pd4
	Andhra Pradesh	Chittoor	Madanapalle, Vayalpad, Punganur, Palamaner	II, VII, XXIV	2298	719	39.4	Gn2 Pd4 Gn3 Pd4 S4 B4/R4

REGION - XXIV (Contd...)

Rainfall pattern all-India one no (s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Andhra Pradesh	Ongole	Markapur, Podili, Kanigiri, Darsi.				19.1	Pd3 B4 Fr4 R4
		Guntur	Vinukonda				42.9	Jk4 Mt4 Q4/ Pu4
		Cuddapah	Rajampet, Rayachoti				31.5	Mt3 B4 Pd4 Jk4/Gn4 Mt4 B4 Pd4 Jk4 Ch4
ZC-146		Ongole	Kandukur, Ongole	III	3421	196	19.1	Jr4 Mt4 Pd4 (To4 F4)/ B4 R4 To4 Mt4 Jr4 F4/Pd4 B4
			Total Region		3494	1469		

REGION - XXV

Rainfall pattern all-India zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
E4(C1E3)B2E2	Andhra Pradesh	Nellore	Udayagiri	IV	472	157	66.6	Pd1
147			Kovur					Pd3Jr4Mt4/Pu4
			Kavali					Jr4Mt4Pd4B4R4
					472	157		

REGION-XXVI

pattern/ all-India zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
E4 (C_1E_3) A_1B_1— C_1E_1 -139, 153	Tamil Nadu	Tanjore	Myuram Nannilam	II	148	145	76.0	Pd1
	Andhra Pradesh	Chittoor	Kalahasti Satyavedu	VIII	407	117	39.4	Pd1 Pd2 Gn4
		Nellore	Sullurpet				66.6	
					555	262		

REGION - XXVII

Rainfall attern/ l-India ne no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000ha)	district % of GIA to GCA	cropping patterns
E4 (C2E2) C2E2 122, 123,	Tamil Nadu	North Arcot	Vaniyambadi Triupathur	IX	252	142	51.2	Pd4 Gn4 Mt4 Jk4 R4 (S4/Pu4)
		Dharmapuri	Uthangarai				15.2	Pu4 Mt4 Jk4 Pd5
	Andhra Pradesh	Chittoor	Kuppam	Spl.-III	76	32	39.4	R4 Pd4 Mt4 Pu4
	Karnataka	Dharwar	Shiggaon, Dharwar, Hubli, Kundagol, Haveri, Savanur, Shirahatti	VIII IX	1775	1107	5.3	Gn3 Jk4 C4/W4/Pu4 Gn4 Jk4 To4 S5
		Belgaum	Bailhongal Hukkeri				10.8	Jk4 C4 Gn4 R4/Pu4 Jk4 C4 Gn4 W4/Pu4 Pd4 Jr4
		Bangalore	Magadi, Devanhalli, Dodaballapur, Nelamangala, Bangalore-(½N)				17.3	C4 Jk4 Gn4
		Tumkur	Tumkur, Kunigal, Gubbi, Turuvekere, Tiptur(½E), Koratagere(½S)				16.3	Pd4 C4 Gn4 Pu4 R2 Pu4/Pd4/Pu4 Pd4/ Pu4 Pd5/Pu4 M4
		Kolar	Chikballapur, Sidlaghatta, Gudibanda, Gauribidanur				26.0	R3 Pu4 Pd4/I4 R3 Gn4 Pd4/Mt4/Pu4/ Pu4 Pd4

REGION - XXVII (contd.)

pattern/ all-India zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000ha)	district % of GIA to GCA	cropping patterns
120, 124, 125 132,	Tamil Nadu	South Arcot	Trukoilur, Kallakurichi	XIII, XIV, XVIII	2902	1349	57.4	
		Tiruchirapalli	Perambalur, Kulathur, Alangudi, Thirumayam				36.0	
		Dharmapuri	Harur				15.2	
		Salem	Attur				30.4	
		Thanjavur	Thanjavur, Arantangi,				76.0	
		North Arcot	Arkonam, Walajahpet Cheyyar, Arni Polur, Chengam, Tiruvannamalai, Gudiyatham, Vellore				51.2	
		Chingleput	Tiruttani				72.7	
		Madurai	Madurai (N), Madurai (S), Melur				37.5	
		Ramanathapuram	Tiruppathur, Sivaganga				38.0	
	Andhra Pradesh	Cuddapah	Badvel, Sidhout	X, XXV	833	191	31.5	Pd3Mt4+Pu4+R
		Chittoor	Bangarupalem, Chittoor Chandragiri, Puttur				39.4	Pd4+B4+Fr4+R4+ Gn3 Pd4+S4+ 'B4+/R4+

ION-XXVII(contd.)

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000.ha)	gross cropped area ('000ha)	district % of GIA to GCA	cropping patterns
133	Tamil Nadu ...	South Arcot	Gingee	IV	194	126	57.4	Pd3 Gn3
		North Arcot	Wandiwash				51.2	
					6032	2947		

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REGION - XXVIII

pattern/ all-India zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha).	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
E4(C2E2)B1C2E1	Tamil Nadu	South Arcot	Vriddachalam	VII, Spl. IV, Spl. V	853	553	57.4	Pd1
134		Tiruchirapalli	Ariyalur, Udayarapalayam				36.0	Pd2Gn4
		Thanjavur	Kumbakonam, Papanasam, Mannargudi, Pattukkottai, Orathanad				76.0	Pd3Jk4Gn4Pu4(Jr4 Pd4Jk4Pu4Jr5Mt5
		Tirunelveli	Tenkasi, Shenkottah				41.4	Pd4Mt4Gn4Jk4/B4

REGION - XXVIII (contd.)

pattern all-India zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patt
(2)	Tamil Nadu	Chingleput	Tiruvallur, Sriprumbudur Kanchipuram, Chingleput, Madurantakam	VII	821	508	72.7	Pd1
								Pd2 Gn2
								Pd3Gn4Mt4/B4/J
		South Arcot	Tindivanam, Villupuram				57.4	
					1674	1061		

REGION - XXIX

Rainfall pattern, all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
E4(C2E2)A1B1C1E1 131	Tamil Nadu	Chinglepaut	Ponneri, Saidapet	I	446	321	72.7	Pd1
		South Arcot	Chidambaram, Cuddalore				57.4	Pd3Gn3L4B4
		Tanjore	Sirkali				76.0	
					446	321		

ION - XXX

ainfall tern -India no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
(C4/C3)C1E3 095,100,103 -108 -114 -107 -109 -113 -115	Andhra Pradesh	West Godavari	Palavaram, Eluru, Chintalapudi, Kuvvur, Tadepalligudem, Tanuku, Bhimavaram	XVII, XXVII	1166	658	77.6	Pd1 Pd2S4 Pd3Pu4Gn4Fr4 Pd3Pu4Fr4S4/04/To5
		Krishna	Nuzvid				60.2	Pu3Pd3Mt4
		Visakhapatnam	Narasapatnam, Chintapalle				35.1	Pu4Pd43404/Jk4/ Gn4/Mt4/Jk4

REGION - XXX (contd)

Rainfall attern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	-Andhra Pradesh	East Godavari	Kothapeta, Alamur, Kakinada, Ramachandrapuram, Mumnidiaram, Razole, Amalapuram	XV	630	523	63.3	Pd1 Pd204Fr4
		West Godavari	Narsapur				77.6	
		Krishna	Bandar, Divi				60.2	

REGION - XXX (contd)

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
	Andhra Pradesh	Guntur	Repalle Bapatla	XIII	392	342	42.9	Pd1 Pd2Fu4 Pd4To4Jr4F4/M
		Ongole	Chirala Addanki				19.1	To4Mt4Jr4F4/F

REGION-XXX(contd.)

Rainfall pattern/ All-India zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
	Karnataka	N.Kanara	Mundgod(½E)	XI	608	282	18.1	Pd1
		Shimoga	BhadraVati(½W) Shikaripur, Shimoga				51.3	Pd2L4/B4/M5/V4/F4 Pd3R4L4/Pu4 R3Pu4Pd4/L4
		Dharwar	Hanagal, &Kalghatg.				5.3	
		Hassan	Belur, Alur, Arkalgud				18.2	
	Himachal Pradesh	Mahasu	Jubbal, Chaupal	XI	83	23	8.0	W4Ba4Mt4M4/Pt4/ Pt4Pd4

(contd.)

nfall ttern -India zone no(s)	State	District	taluk	rainfall zone no(s) in state	Geographical area ('000ha)	Gross cropped area (000 ha.)	district % of GIA to GCA	Cropping patterns
	Andhra Pradesh	Krishna	Gudivada, Kaikalur, Vijawada, Gannavaram, Jaggayyapet, Nandigama	XIV, XXVI	2416	1691	60.2	Pd1 Pd2Pu4/R4/Fb4
		Guntur	Guntur, Tenali				42.9	Pd3R404 Pd3PuB404
		Visakhapatnam	Vizianagram, Srunga Varapukota, Gajapathinagram, Visakhapatnam, Anakapalle, Chodavaram Yellamanchili Bheemunipatnam				35.1	Pd3Pu4Fr4To4 Pd3Gn4Fb4/Pu4 Pd3Pu4Gn4[illegible]4/Fr4 Pd4Fb4Gn4Pu4 Pd4Ch4[illegible]4Pu4To4 B3Pd4R404 Gn3(Pd4Fb4)/B4Fu4 Jr3Pu4Pd4/Gn4
		East Godavari	Rajahmundary, Tuni, Peddapuram, Prathipadu, Pithapuram.				63.3	
		Srikakulam	Salur, Bobbili, Khchapuram, Sompeta, Tekkali, Narasannapet, Pathapatnam, Srikakulam, Cheepurupalle				45.8	

SECTION-XXX(contd.)

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Orissa	Ganjam	Chatarpur	II	77	65	38.3	Pd2Pu4

Rainfall pattern All-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
11 1	Andhra Pradesh	Guntur	Sattanapalli, Palnad, Narsaraopet	XII	569	336	42.9	Pd4 Gn4 Mt4 Pd4 Td4 Jr4 Fr4/Mt Mt4 B4 Pd4— Jk4 Ch4/Jr4
	Karnataka	Shimoga	Bhadrawati (½ E) Channagiri (½ W) Honnali (½ W)	X	264	190	51.3	Pd1 Pd4 R4 Jk4 Gn4/— Pu4 Pd4 C4 Jk4 Mt4 Ch4
		Dharwar	Byadgi, Hirekerur				5.3	
					6204	4110		

REGION - XXXI

pattern all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
E4 (B4/B3)C1E3 054 -074,075 -078,079- 081	Orissa	Cuttack	Kujang, Kendrapara Kanika, **Patamundai** **Marsaghai,** **Aul**	VI	351	40.4	274	Pd1 Pd2 Pu4

(contd)

REGION - XXXI

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall Zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
	Orissa	Balasore	Jaleswar, Basta	V XI	613	221	12.4	Pd1 Pd2 Pu4/G4
		Puri	Nayagarh				31.0	Pd3 Pu3
		Ganjam	R.udayagiri Surada				38.3	Pd3 Pu4 R4

(cont.)

rainfall pattern [illegible]	state	district	taluk	rainfall zone (no.(s) in state	geographical area ('000ha)	gross cropped area ('000ha)	district % of GIA to GCA	cropped patterns
	Andhra Pradesh	Srikakulam	Parvatipuram	XXVIII	685	177		Pd2 Pu^4/R^4/Fb^4
			Palakonda					Pd3 Gn^4+Fb^4/Pu^4
		East Godavari	**Yellow-aram**					Pu^4 Pd^4+B^4+O^4/Jk^4+Gn^1 **Mt4** /Jk^4
			Ramachodavaram					
	Orissa	Koraput	Gunupur	III, IV	1867	708	3.4	Pd1
			Bissamcuttack					Pd2 Pu^4
			Rayagada					Pd3 Pu^4+R^4
		Phulbani	G.udayagire				15.6	Pd3 O^4+M^4+Mt^4
		Ganjam	Ghumusur, Aska **Digapahandi Y, Chikiti**				38.3	Pd3 Pu^4+Mt^4 **Pd3 O^4+R^4+Mt5**
			Berhampur, Kodala Parlakhemundi					Pd^4+R^4+O^4+Pu^4+Mt^4
		Puri	Puri, Banpur Krishna Prasad				31.0	
					3516	1380		

REGION - XXXII

Rainfall pattern all-India zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
E4(A1C3)C1E2	Maharashtra	Poona	Vadgaon(Mawal) (½E),	IX	562	262	10.7	Pd2 Jr2
072,073			Mulshi(½E), Haveli(½W),					Pd3 R4 Jr4 Mt4
			Khed(½W), Ambegaon(½W),					Pd3 Gn4 Jk4 S4
			Bhor(½E)					B3 Jr3 Pd5
		Kolhapur	Kolhapur(Karvir),				13.5	B3 Jr4 Pd4 Pd5
			Gadhinglaj, Kagal					B3 Jr4 Pd5 Gn5
		Sangli	Shirala(1/3 central)				10.5	Jr3 Pd4 Pu4 Gn4 (R5)
		Satara	Satara (1/3 central)				13.7	Gn4 Jk4 Jr4
								Gn4 Pd4 Jk4 M
					562	262		

REGION - XXXIII

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
E4(A1B1C2)C1E3 067,069	Andhra Pradesh	Visakhapatnam	Paderu	Spl. - I	310	45	35.1	Pd3 R4 O
	Karnataka	Shimoga	Sorab(2/3E),	XII	299	113	51.3	Pd1
		N. Kanara	Mundgod(½W),				18.1	Pd4 R4 I Jk5
			Haliyal					
		Belgaum	Belgaum				10.8	
					609	156		

REGION - XXXIV

Rainfall pattern/ All-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
E4(A2B1C1)C1E3 C38,041,	Karnataka	Chikmagalur	N. Rajpura	XVIII	81	9	12.5	Pd2 L4/B4/V4/M5/F4
	Himachal Pradesh	Sirmaur	Rajgarh, Pachhad, Paonta Sahib, Rainka, Shilai, Nahan	I	225	71	22.6	W3 M3 G4 / Pd4
					306	80		

REGION - XXXV

Rainfall pattern all-India zone no(s)	state	district	taluk	rainfall zone no.(s) in state	reographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
E4(A2B2)C1E3	Orissa	Mayur-bhanj	Karanjia, Rairangpur	VIII IX	2320	1395	7.4	Pd1
032,033		Keonjhar	Anandapur				3.7	Pd2 Pu4
		Cuttak	Sukinda, Jaipur				40.4	Pd2 G4
			Darpan , Salepur,					Pd2 O4 Pu5
			Cuttack, Athgarh,					Pd3 Pu4
			Tigiria, Baramba,					
			Narsingpur , Banki,					
			Jagatsinghpur, Niali					
		Dhenkanal	Hindol				10.0	
		Kalahandi	Lanjigarh				5.7	
		Puri	Khandpara, Daspalla,				31.0	
			Nimapara, Bhubaneswar.					
			Pipli, Khurda, Ranpur					
					2320	1395		

REGION - XXXVI

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
E4(A4/A3)C_1E_3	Maharashtra	Kolaba	Uran,	XVI	2623	583	2.0	Pd1
001,002,			Roha,					Pd2 R4
-017,018,			Pali(Sudhagadh					Pd2 Fr4 R4
-025,026			Alibag,					Pd2 R4 Mt4(Pu4)
			Pen,					Pd3 R4 Mt4
			Panvel,					Pd3 Fr4 L4 (R5)
			Khalapur,					Pd3 R4 Mt4 S4
			Karjat,					Pd3 R4 O4 W4
		Mahad	Poladpur($\frac{1}{2}$W),					R3 Mt3 O4 Pu4 F
		(2/3W)	ShriWardhan,					
			Mangaon,					
			Mhasla,					
			Murud					
		Thanna	Thana,					
			Kalyan,					
			Murbad,					
			Shahapur,					
			Ulhasnagar,					
			Bhiwandi,					
			Vada,					
			Mokhada					

REGION-XXXVI (contd..)

Rainfall pattern/ all-India zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000ha)	district % of GIA to GCA	cropping patterns
		Ratnagiri	SawantWadi, Kudal, Malwan, Kankavali, Devgarh Rajapur, Lanja, Ratnagiri, Sangameshwar, Chiplun, Khed, Guhagar, Dapoli, Mandangad Vengurla.				5.5	Pd3 R4 Mt4 S Pd3 R4 O4 W4 R3 Mt3 O4 Pu4 Pd4
		Kolhapur	Radhanagari($\frac{1}{2}$W), Bavda				13.5	
		Nasik	Igatpuri($\frac{1}{4}$ W)				11.7	
	Karnataka	North Kanara	Bhatkal, Kumta, Honavar	XVII	169	27	18.1	Pd1 Pd2 L4/B4/ M5/V4/F4

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Karnataka	North Kanara	Karwar, Ankola, Siddapur	XV, XVI	722	114	18.1	Pd1 Pd2 L4/B4/ M5/V4/F4
		Shimoga	Sagar(½W), Hosanagar(½ W), Tirthahalli (2/3W)				51.3	L2 Pd3 L3 Pd3
		Chikmagalur	Koppa, Sringeri, Mudigere				12.5	
	Orissa	Koraput	Motu Malkangiri Jeypore	X	777	249	3.4	Pd1 Pd2 R4

[illegible] - XXXVI (contd)

Rainfall pattern/ all-india zone no(s)	state	district	taluk	rainfall zone no.(s) (in state)	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Maharashtra	Kolhapur	Chandgad	XIV	96	27	13.5	Pd3 R4 Mt4
	Karnataka	North Kanara	Supa, Yellapur, Sirsi,	XIII,XIV	875	118	18.1	Pd1 Pd2 L4/B4/ M5/V4/F4
		Belgaum	Khanapur				10.8	
		Shimoga	Sagar(½E), Tirthahalli(1/3 E), Hosanagar(½ E), Sorab(1/3 W)				51.3	
					5262	1118		

REGION - XXXVII

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
C1E3(A4/A3)E4 003, 019	Bihar	Purnea	Kishanganj	XVII	193	156	8.6	Pd1

REGION - XXXVII (contd)

Rainfall pattern all-India zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
	Bihar	Purnea	Araria	XVI	267	257	8.6	Pd2Jr4
					460	413		

REGION - XXXVIII

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
C1E3(E4)C1E3 158, 164	Karnataka	Mysore	Gundlupet	XXIII	264	127	14.0	Jk3 Pu4 R4/Gn4
			Chamrajnagar					Jk4 Pu4 R4 Pd4/Gn5 Pd5
	Himachal Pradesh	Kinnaur	Sangle	XV	3	2	55.0	Mt1
					267	129		

REGION - XXXIX

Rainfall pattern, all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
C1E3(C1E3)C1E3 140,144, 151	Tamil Nadu	Dharmapuri	Hosur, Denkanikota	XIX	306	115	15.2	R3 Pu4 O4
	Karnataka	Mandya	Maddur, Mandya, Srirangapatna, Nagamangla, Pandavapura, Malavalli K.R. Pet	XIX, XXIV	1887	915	33.6	R2 Pd4
								R3 Pu4 Nf4
								R3 Pu4 Pd4 / I4
		Mysore	K.R. Nagar, Nanjandud, T.N.Pura, Yelandur, Mysore, H.D. Kote. Hunsur, [illegible]. Fatna, Kollegal				14.0	R3 Pd4 Pu4 I4/Jk4
								Nf2 Pd2 R4
								Jk3 Pu4 R4 / Gn4
		Hassan	Holenarsipur, Hassan, Arsikere, C. Patna				18.2	Jk4 Pu4 R4 Pd4/Gn5 Pd5
		Tumkur	Tiptur ($\frac{1}{2}$W)				16.3	Pd4 R4 Pu4 / I4
								Pd4 R4 Pu4 S4 / Jk4
					2193	1030		

EGION - XXXX

Rainfall Patterr all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
C1E3(C2E2)C1E3	Tamil Nadu	Dharmapuri	Krishnagiri, Dharmapuri,	XX	889	605	15.2	Gn3 Jk4 B4 Pd4
			Mettur, Omalur, Salem,					Gn4 Pd4 Mt4 V4 Jk4/Jr4
			Rasipuram, Sankari					R4 Jk4 Pu4 Gn4
			Tiruchengode, Namakkal					B4 Gn4 Jr4 Pd4 Pu4,Mt4 Jk4 Pd5 Pd4Gn4Mt4Jk4R4S4/Pu
	Karnataka	Bangalore	Ramanagram, Bangalore (S)	XX	402	190	17.3	R2 Pu4/Pd4/- Pu4 Pd4/Pu4- Pd5/Pu4 M4
			Kanakpura, Anekal,					R3 Pd4 Pu4- L4/Jk4
			Bangalore (½S),					
			Channapatna					
					1291	795		

REGION - IXL

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
C1E3(B1C3)C1E3 096	Assam	Nowgong	Lanka, Lumding	IV	80	44	n.a.	Pd2Ju4
					80	44		

REGION - VIIIL

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
C1E3(A1B2C1) C1E3	Assam	Nowgong	Jamunamukh, Kampur	I	68	38	n.a.	Pd2Ju4
059					68	38		

REGION - VIII

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
C1E3(A2C1E1) C1E3 052	Jammu & Kashmir	Udhampur,	Reasi, Udhampur, Ramnagar	VI	326	70	10.0	M3W3 M3W4Be4/Pu4/Mt4/Pd4
					326	70		

REGION - VII

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
C1E3(A2B2)C1E3 054, 055	Assam	Nowgong	Hojai, Murajhar	III	47.	26	n.a.	Pd2Ju4
	Bihar	Santal - Parganas	Pakur	XV	178	104	8.8	Pd1
	West Bengal	Malda		III, IV	4116	3362	61.9	Pd1 Pd3Pu4
		West Dinajpur					34.9	
		24-Parganas					8.9	
		Hooghly					48.5	
		Howrah					26.7	
		Midnapore					29.6	

REGION - VIL (contd)

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross Cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
	Orissa	Balasore	Chandbali, Dhamnagar, Bhadrak, Soro, Balasore Nilgiri	XII	1053	577	12.4	Pd1
		Mayurbhanj	Betnote, Udala, Barapada					

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REGION -VIL (contd.)

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
073	Assam	N.C. Hills	Maibong	II	113	23	n.a.	Pd1
					5508	4092		

GION - VL

Rainfall Pattern all-India Zone no(s)	State	District	Taluk	Rainfall Zone No.(s) in State	Geographical (area) ('000 ha)	Gross cropped area ('000 ha)	District % of GIA to GCA	Cropping Patterns
C1E3(A4/A3)C1E3 004,006, 027	Karnataka	Coorg	Virajpet(½W)	XXVI,XXI	604	224	6.3	Pd1
			Mereara					L2 Pd3
		S.Kanara	Bantwal, Mangalore, Udipi, Coondapur				31.9	L3 Pd3
		Coorg	Virajpet(½E)	XXV	371	135	6.3	L2 Pd3
			Somvarpet					L3 Pd3
		Hassan	Saleshpur				18.2	
		Chikmagalur	Chikmagalur(½W)				12.5	
					974	359		

REGION - IVL

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
C1 E3(B1C2E1) C2E2 102	Himachal Pradesh	Chamba	Chamba, Chaurah	XVI	285	35	12.3	M2 W4
					285	35		

REGION - IIIL

Rainfall Pattern all-India zone no(s)	State	District	Taluk	Rainfall Zone No(s) in State	Geographical (area) ('000 ha)	Gross cropped area ('000 ha)	District % of GIA to GCA	Cropping patterns
C1E3(B1C3)B2E2 098	Kerala	**Trivandrum**	**Neyatinkara**	I	57	61	n.a.	L3 Ta4 (Pd4)
					57	61		

REGION - IIL

Rainfall Pattern all-India Zone no.(s)	State	District	Taluk	Rainfall Zone No(s) in State	Geographical area ('000 ha)	Gross cropped area ('000 ha)	District % of GIA to GCA	Cropping patterns
C1E3(B3C1)E4	W.B.	Nadia		II	2085	2167	2.7	Fd1
080		Murshidabad					24.3	Fd3 Fu4 Ju4
		Burdwan					57.4	
		Birbhum					73.0	
					2085	2167		

REGION - II

Rainfall Pattern all-India Zone no(s)	State	District	Taluk	Rainfall (Zone No(s) in State	Geographical (area) ('000 ha)	Gross cropped area ('000 ha	District % of GIA to GCA	Cropping patterns
C1 E3(A4/A3) B1C1E2 005,028	Karnataka	S. Kanara	Karkal, Puttur	XXII	462	105	31.9	Pd1
			Sulia Belthangady					Pd2L4/B4/M5/V4/F4
								Pd2L4
	Kerala	Palghat	Chittur,, Alathur, Palghat, Ottapalam	VI	404	326	n.a.	L2 Pd4
		Cannanore	North Wynad					
					866	431		

REGION - L

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
C2E2(C2E2)C1E3	H.P.	Kulu	Kulu	XVII	460	34	5.3	Mt3 Ba4
127,129		Kinnaur	Nachhar				55.0	W3 M4 Ba4-/Ba4 Pd4
		Chamba	Brahmaur				12.3	W4 M4 Mt4
	J & K.	Doda	Doda, Ramban, Bhaderwah	VIII	247	41	14.5	M1 M3 W4 Ba4/-Pu4/Mt4/Pd4
					707	75		

REGION - LI

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
C2E2(B2C1E1)C1E2 088	Jammu & Kashmir	Punch	Haveli, Mendhar	IX	114	29	12.5	M1
					=			
					114	29		

REGION - LII

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	Geo-graphical area ('000 ha)	Gross cropped area ('000ha)	district % of GIA to GCA	cropping patterns
C2E2(A2C1E1)C1E3	Jammu & Kashmir	Udhampur	Gool Gulab Garh	VII	248	51	10.0	M1 M2W4
053								
		Rajauri	Rajauri, Budhal		248	51	12.5	

REGION - LIII

Rainfall pattern all-India Zone no(s)	state	district	taluk	rain-fall zone no(s) (in state)	Geo-graphical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
C2E2(A2B1C1)C2E2 042	Himachal Pradesh	Kangra	Palampur, Kangra	XVIII	311	110	21.6	W3 M4 Pd4 M3 W4 Pd4
		Chamba	Bhattiyat				12.3	
					311	110		

REGION - LIV

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) (in state)	Geo-graphical area ('000 ha)	Gross cropped area ('000ha)	district % of GIA to GCA	cropping patterns
C3E1(E4)C1E3 154, 157 168	Jammu & Kashmir	Baramula	Baramula, Sonawari Bandipore, Sopore, Handwara, Karnah, Kupwara, Gulmarg, Uri	X, XII	428	182	48.0	M1 M3W4Ba4/Pu4/Mt4/Pd4 Pd2 M4 Pd3 M3 Pd3 M4 Pu4/W4
		Doda	Kishtwar				14.5	
		Anantnag	Kulgam				60.0	
					428	182		

REGION - LV

Rainfall pattern all-India Zone No(s)	state	district	taluk	rain-fall zone no(s) in state	Geo-graphical area ('000 ha)	Gross cropped area ('000ha)	district % of GIA to GCA	cropping patterns
B1E3(A3B1)B1C1E2 020	Kerala	Cannanore	Kasaragod, Hosdurg, Tallipparamba, Tellicherry, Cannanore	VII	1689	1221	n.a.	L2 Pd4 L3Pd3 (Ta4) Pd2 L4 Pd3 L3
		Kozhikode	Badagara, Quilandy, South-Wynad, Calicut					
		Malappu-ram	Ernad, Tirur, Perintalmanna, Ponnari					
		Palghat	Mannarghat					
		Trichur	Talappilly Trichur, Chavakkad, Mukandapuram, Kodungallur					
		Erna-kulam	Parur Alwaye					
					1689	1221		

REGION - LVI

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone No(s) in state	Geo-graphical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
B1C1E2(A1B1C2) B1C'E2 068, 041	Kerala	**Trivandrum**	Chirayinkil Nedumangad Trivandrum	II	**162**	**182**	**n.a.**	L3Ta4(Pd4)

REGION - LVI (contd).

Rainfall pattern all-India Zone no (s)	state	district	taluk	rainfall zone no(s) in state	Geo-graphical area ('000 ha)	Gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Kerala	Quilon	Karunagapally, Quilon	III	59	11	n.a.	L3Ta4(Pd4)

REGION -LVII

Rainfall pattern/ all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping pattern
B1C1E2(A2B1C1) E4 043, 060, 045	Assam	Kamrup	Kamalpur, Gauhati, Jhalukbari Palasbari	VI	131	112	n.a.	Pd1

REGION LVII (contd.)

Rainfall pattern all-India Zone No(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Assam	Darrang	Kalaigaon, Dalgaon, Mangaldai	V	297	139	n.a.	Pd2 L4 Pd2 Ju4
		Nowgong	Laharighat, Dhing, Rupahihat					

REGION - LVII (contd.)

Rainfall pattern/ all-India Zone No(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Assam	Kamrup	Rangia Hajo	XI	119	70	n.a.	Pd1
					697	321		

REGION - LVIII

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
P1C1E2(A4/A3)A1B1E2 010, 022	Kerala	Kottayam	Kottayam, Meenachil, Changanacherry, Kanjirappally, Peermade	V	456	285	n.a.	L2 Pd4 L3 Pd3
		Ernakulam	Muvathupuzha, Thodupuzha					

REGION LVII (contd.)

Rainfall all-India Zone No (s)	state	district	taluk	rain-fall zone No(s) in state	geographical area ('000 ha)	gross cropped area (000ha)	district % of GIA to GCA	cropping patt
	Kerala	Quilon	Pathanapuram,	IV	877	763	n.a.	L2 Pd4
			Kottarakkara,					L3 Pd3
			Kunnathur,					L3 [illegible] (Pd 4)
			Pathanamthitta					
		Alleppey	Mavelikkara,					
			Chengannur,					
			Karthigapally					
			Tiruvalla, Kuttanad,					
			Ambalapuzha					
			Shertalai					
		Kottayam	Vaikom, Devicolam ($\frac{1}{4}$W)					
		Eranakulam	Kunnathunad,					
			Kanayannur ,					
			Cochin					

REGION - LIX

Rainfall pattern all-India zone no(s)	state	district	taluk	rainfall zone no (s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
3: C1E2(A4/A3)C1E3 021, 007, 023, 008	Assam	Darrang	Udalguri, Majbat, Tezpur	VII	771	347	n.a.	Pd1 Pd2L4 Pd2Ju4
		Sibsagar	Dergaon, Golaghat, Sarupathar, Bokakhat					
		Nowgong	Marigaon, Mikirbheta, Nowgong, Samaguri, Roha					

REGION LIX (contd.)

rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
	Assam	Darrang	Dhekiajuli Rangapara Chutia Behali Gohpur	VIII	452	136	n.a.	Pd2 L4
	West Bengal	Darjeeling		V	303	117	22.3	Pd3M4L4

REGION LIX (contd).

Rainfall pattern/ all-India zone no(s)	state	district	taluk	rainfall zone no (s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Assam	Sibsagar	Jorhat, Teok, Titabar, Mariani	IX	193	74	n.a.	Fdl

FEGION - LIX (contd).

Rainfall pattern all-India zone no(s)	state	district	taluk	rainfall zone no (s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
[illegible]	Assam	Sibsagar	Anguri, Nazira, Moranhat, Sonari	X	741	214	n.a.	Pd1 Pd2 L4
		Lakhimpur	Moran, Bardubi, Chabua, Tinsukia, Sadiya, Doomdooma, Digboi, Margherita, Jaipur					
					2,466	938		

REGION - LX

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no (s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
A1C1E2(A4/A3)C1E3								
	Assam	Goalpara	Gossaingaon, Sidli, Bijni, Kokrajhar	XIV	1178	391	n.a.	Pd1
011 024, 009								Pd214
		Lakhimpur	Bihpuria, North Lakhimpur Dhakua - Khana, Dhemaji, Dibrugarh, Jonai					

REGION LX (contd.)

Rainfall pattern all-India zone no(s)	state	district	taluk	rainfall zone no(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Assam	Goalpara	Abhayapuri, Goalpara, Dudhnai,	XII	981	529	n.a.	Fd1 Fd2 I4
		Kamrup	Sorbhog, Patachar, Kuchi, Baghbor, Tarabari, Barama, Tamulpur, Nalbari, Chhaygaon, Boko, Barpeta					
		Darrang	Paneri					

REGION LX (contd.)

Rainfall pattern all-India zone no(s)	state	district	taluk	rainfall zone no (s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
	Assam	Goalpara	Golokganj, Dhubri, Bilasipara, South Salmara, Mankachar, Lakhipur	XIII	344	152	n.a.	Pd1
	West Bengal	Cooch-Behar		VI	963.	734	5.2	Pd1
		Jalpaiguri					21.8	
					3467	1806		

REGION - LXI

Rainfall pattern all-India Zone no(s)	state	district	taluk	rainfall zone no.(s) in state	geographical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	cropping patterns
$\bar{A}1\bar{B}1\bar{C}1\bar{E}1(\bar{A}1_{33})$ C1E3	Assam	N.C. Hills	Haflong(½N)	XV	188	38	n.a.	Pd1
055								
					188	38		

REGION - LXII

Rainfall Pattern all-India Zones no(s)	State	District	taluk	rain-fall zone no(s) in the State	geographical area ('000 ha)	GCA ('000 ha)	District % of GIA to GCA	Cropping pattern
A2C1E1(A4) C1E3 013,014	Assam	Sibsagar	Majuli Sibsagar	XVI	173	66	n.a.	Pd1

REGION - LXII (contd)

Rainfall pattern all-India zone (s)	state	district	taluk	rainfall zone no(s) in state	geo-raphi-cal area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
	Assam	Cachar	Hailakandi, Katlichara, Patharkandi, Badarpur, Ratabari, Silchar, Udarband, Lakhipur, Sonai	XVII	5567	209	n.a.	Pd_1
					5557	209		

REGION - LXII (contd.)

Rainfall pattern all-India zone (s)	state	district	taluk	rain-fall zone no(s) in state	geo-graphical area ('000 ha)	gross cropped area ('000 ha)	district % of GIA to GCA	Cropping patterns
4	Assam	Cachar	Karimganj, Kattigora, Borkhola	XVIII	327	90	n.a.	
		N C Hills	Haflong (½ S)					
					1055	365		

Appendix 14.6

(Paragraph 14.6.96)

Statement VI - All India Cropping Patterns

Crop		Number of patterns	Crop		Number of patterns
Paddy	(Pd)	30	Gram	(G)	7
Jower Kharif	(Jk)	17	Other Pulses	(Pu)	7
Jower Rabi	(Jr)	13	Groundnut	(Gn)	9
Bajra	(B)	20	Other oilseeds	(O)	1
Maize	(M)	12	Cotton	(C)	16
Ragi	(R)	7	Fodder	(F)	2
Small Millets	(Mt)	7	Fruits	(Fr)	2
Wheat	(W)	19	Potato	(Pt)	1
Barley	(Ba)	3	Tobacco	(To)	2
			Plantation	(L)	2

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Appendix 14.6 (Paragraph 14.6.96)

Statement VI- All-India Cropping Patterns

Paddy

1. Pd1
2. Pd2 M4/B4/Mt4/Pu4/O4/Fr4/Gn4/W4/V4/G4/F4/Jr4/B4 Jr4/Mt4 Pu4/Pu4 O5/R4/S4/Fb4/Ju4/L4/W5 Pu5
3. Pd3 L3/L3 M4/M4
4. Pd3 M3/M4 Jk4/M4 O4/M4 W4/M4 V4/M4 Pu4/M4 O4 Pu4/M4 O4 Mt4
5. Pd3 Pu3/Pu4 R4/Pu4 Mt4/Pu4 G4/Pu4 W4/Pu4 Ju4/Pu4 Gn4/Pu4 S4 G4/Pu4 Gn4 Fb4/Pu4 O4 Fr4/Pu4 O5 Mt5/Pu4 Jk4 Fr4/Pu4 Jk4 R4
6. Pd3 R4/R4 O4/R4 S4/R4 Gn4/R4 Mt4/R4 Mt4 W4/R4 Pu4/R4 O4 W4/R4 B4 F4/R4 L4/R4 Jk4
7. Pd3 B4 C4/Mt4 C4/Mt4 L4/F4 V4
8. Pd3 Mt4 . Pu4/O4/G4/W4/O4 M4/L4 B4
9. Pd3 Gn3 Gn4/Jk4 Mt4/Jk4 B4/Jk4 S4/Jk4 O4/Jk4 Pu4/Gn4 (B4/Jk4/M4/Pu4/R4/F4 R4/Mt4/Fb4)
10. Pd3 Jr3/Jr4 M4/Jr4 Jk4/Jr4 Pu4/Jr4 S4
11. Pd3 Ba4 Pu4/Pu4 T4/W4 S5 T4
12. Pd3 W3/W3 G4/W4 M4/Pu4/M4 Pu4/M4 Pu4/G4 Ba4/G4 S4/Mt4/S4/Ba4/Ba4 G4/Pu4 G5/G4/M4 Ba4/S4 Ba4/O4/Mt4 Pu4/W4 Pu4/Ba4 Pu4/5/Ba4 Pu5 S5/Ba4 Pu5 G5/Ba4 Mt4/Ba4/M4 G4/Ba4 Pu4/G4/ W4 O4 M4/S4/G4/Mt4 Pu4
13. Pd4 Pu4 Jk4 M4/T4/O4/Jr4
14. Pd4 Pu4 Jr4 M4/Jk4
15. Pd4 Pu4 O4 Mt4 R4 / B4
16. Pd4 B4 Jk4 Gn4 R4/C4/Jr5
17. Pd4 C4 Jk4 Gn4/Gn4 Mt4/Mt4 Ch4
18. Pd4 M4 Jk4 Gn4/Pu4/O4
19. Pd4 Mt4 Gn4 Jk4/(Jk4 Jr4)/(B4 C4)
20. Pd4 Jk4 Gn4/B4/(Jr4 Gn4)/Jr4 B4

Appendix 14.6 (Contd)

Statement - VI(Contd)

21. Pd4 Ba4(B4 W5)/(Pu4 M4 G4)

22. pd4 Ba4 W4(G4 Jk4)/(G4 Mt4 B4)/(pu4 B4)/(pu4 S4)/Mt4 O4

23. pd4 Ba4 W4 Jk4/pu4/pu4 Jk4/pu4 M4

24. pd4 W4 S4/M4/S4 G4/S4 M5

25. Pd4 B4 W4 Ba5/Ba4 G4/Ba4 T4

26. pd4 G4 W4 S4/pu5/Jk5/Ba4 pu4/Ba4 Jk4/Ba4

27. pd4 R4 (Jk4 pu4)/(Jk4 Gn4)/(pu4 S4)/(pu4 O4)/(Mt4 Jk5 O4)/
(L4 pu4)/pu4/L4

28. pd4 Jr4 To4 F4/Mt4/Mt4 Fr4/Ch4 pu4

29. pd4 Jr4 B4 Gr4 T4 Mt4

30. pd4 Gn4 (R4 B4 Fb4)/(M4 Jk4 pu4)

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Appendix 14.6 (Contd)

Statement VI - (Contd)

Wheat

1. W2 G4/F4/Jk4

2. W3 M3/M3 Pd4/Pd3 M4/M4(Pd4/Pd4 Fr4/F4/F4 Gn4/F4 G4/B4/
Pu4 B4/Pu4 Pd4/Gn4/Ba4/Pt4/Pu4)

3. W3 Pd4 M4/M4 F4/M5 G5/S4 B5 G5/G4/04/S4

4. W3 S4 Pd4/Pd4 F4/Pd4 B4/F4/M4 F4/M4 B4/Pd4 M4

5. W3 B4 M4/Ba4 Pu4/Ba4 M4 S5

Ba4

6. W3 B4 G4 ~~Bu4~~/Jk4/Ba4 F5 Pu5/Gn4 Ba4/Pu4/F5 05

7. W3 Jk4 G4/G4 F4/F4/04 C4

8. W7 04 Pu4/C4/Pu4 G4

9. W3 F4 Gn4/G4 B4/G4 C4/G4 Pd4/M4/Pd4/Gn4 B4 C4/G4/B4/C4 M4

10. W3 G4 Pd4/Pd4 B4/Pd4 Jk4/04/Pd4 04/Pd4 M4/Jk4/Jk4
B4/Jk4 S4/ Jk4 04/04 Pu4/Pd4 B4/Pd4 Jk4/04/Pd4,
04/Pd4 M4/Jk4/Jk4 B4/ Jk4 S4/Jk4 04/04 Pu4/Jk4
Ba4 F5/Pu4/F4/(Pu4/Jk4 F5 Pu5)

11. W4 F4 S4/G4/C4

12. W4 Pd4 S4/Mt4/Mt4 Ba4/Mt4 04/Mt4 G4/Mt4 F4 Jk4/S4 F4/
S4 M4/S4 G4/S4 Pu5/S5 Gn4/S4 G4 Jk5/B4 C4

13. W4 Pd4 S4/Pu4 Jk4/Ba4 Gn4/Ba4 Jk4/B4 Jk4/Jk5 S5/M4/M4 S4

14. W4 Mt4 Ba4 M4/Pt4/Pt4 Pd4/F4 04/F4 Pd4

15. W4 M4 (Pu4 Jk4 G4)/(B4 Gn4/5 G4/Pu4)/(F4 G4 Gn4)/Mt4/Ba4 Pd4

16. W4 M4 Pu4 (B4 Pd4)/(B4 Ba4)/S4/S4 F4/Pd4 Gn5

17. W4 Jk4 04/F4/F4 Mt4 Pu4

18. W4 Pd4 M4 G4/G4 B4/Gn4/Gn4 Ba4/S4/5/S4 Ba5/Jk4/Jk5 S5/
B4 04 Ba4 Jk5/Ba4/5/Ba5 S5 B5 B4 C4

19. W4 G4 [B4(04/5/Pd4 M4/Pd4 Pu5Ba4 Pu4 M4)/Gn4 Ba4]/(F Jk4/
Jk4 Pu4/Jk4 T5/Jk4)/(Pu4 04)/C4

सत्यमेव जयते

Appendix 14.6. (Contd)
Statement VI (Contd)

Bajra

1. B1

2. B2 Pu4/F4/Jk4/04/G4/Pu3/Jr4

   Pu4/
3. B3 Pu3/Pu4 G4/Pu4 F4/Pu4 W4/Pu4 C4/Pu4 Gn4/Pu4 Ba4/
Pu4 C4^04/Pu4 Ba4 V4/Pu4 Pd4/Pu4 R4 Pd4/F3 Jr4/F3/F4/
F4 04 Jk4/F4 04/F4 Jk4/Jk4 04/W4

4. B3 G3/G3 W4/G4 Pu4/G4 W4/G4 04/G4/G4 F4/G4 Ba4

5. B3 W4 Jk4/Jk4 C4/F4 Gn5/F4 05/Gn4 G4/G4/Gn4/Pd4/Pd4 To4/
Pd4 Mt5/Ba4 G4

6. B3 Jk4 Pu4/Gn4/F4/F4 Pu4/F4 W4 /F4 Gn4/04/C4 Gn4/Jr4 Gn4/
Jr4/C4

7. B3 Jr3/Jr3 Pd4/Jr4 Pd4/Jr4 Pd5

8. B3 To4 Mt4/Mt4 Pd4

9. B3 Gn3/Gn4/Gn4 Jk4/Gn4 F4/C4 Gn4/ C4 Mt4/Gn4 S4/Gn4 04

10. B4 Jk4 Gn4 Jr4/Jr4 Mt4/F4

11. B4 Jk4 04 C4/(F4 W4 W5 05)/(Gn4 M4 Pu4)

12. B4 Jk4 Pd4 W4/F4/C4

13. B4 Gn4 W4 G4/G4 Jk4/Ba4 Jk4/Ba4 Pu4

14. B4 Jk4 W4 04/Gn4/C4/05 Pu5

15. B4 Ba4 G4 (W4 Pu5)/(Jk4 04)

16. B4 W4 C4 F4

17. B4 W4 G4(Gn4/04)/Jk4/F4/M4 Ba4

18. B4 Pu4 04 W4/F4/Mt4

19. B4 Pu4 W4 (Pd4 R4)/G4/Ba4/Ba4 G4/F4

20. B4 Pd4 R4 M4/04

Appendix 14.6 (Contd)

Statement VI (Contd)

Jowar (Rabi)

1. Jr1
2. Jr2 B4/Pu4/T4/O4/Gn4W4
3. Jr3/B3/B4/Gn4/Pd4/Pd4Gn4Pu4/Pd4Gn4Jk4/Pd4Pu4/Pd4Pu4Mt4/Pd4/Gn4/Gn4Pd4Mt4/Gn4Mt4/Gn4Mt4Jk4/C4Jk4/C4W4
4. Jr3B4S4/Pu4/O4/C4/O4C4/C4Pu4/W4/Gn4T4/Gn4C4/Gn4 O4
5. Jr3Pu4 O4 /C4/O4C4/O4W4/O4R4/Pd4/Pd4Jk4/Gn4/G4Jk4/5
6. Jr3C3/C3Gn4/C3 O4/C4Pd4
7. Jr4Pu4Pd4/G4
8. Jr4Pu4Jk4Pd4/O4/Gn4/O4W4
9. Jr4Gn4Mt4/Pu4Mt4
10. Jr4Gn4Pu4(T4Jk4)/(T4 O4)/(Jk4Pd4)/(Jk4/ Jk4 O4)
11. Jr4 O4T4/T4B4/(C4Pu4)/(C4Gn4)/(Pd4Mt4)
12. Jr4 O4W4Jk4/Jk4Pu4/C4Pu4/C4Pd4/C4Pd4Jk4/Pd4Jk4/Pd4Pu4
13. Jr4Pd4(Mt4To4/B4R4)/(Jk4B4Pu4)

सत्यमेव जयते

Appendix 14.6 (Contd)
Statement VI (Contd)

Groundnut

1. Gn1

2. Gn2 B4/Jk4/C4/W4/F4 Jk4/Pu4/Pd4/Jr4

3. Gn3 B3/B4/B4 F4/B4 C4/B4 Jk4/B4 Jr4/Jk4 C4/Jk4 Mt4/Jk4 Pd4/ Jk4 To4/Jk4 Pu4/Jk4 S4/Jk4 L4 Mt4/Pd4 B4 Pu4/Pd4 Fb4

4. Gn3 Pd4 S4/B4/R4/Jk4 Jr4/Jk4

5. Gn4 Pu4 F4/B4/R4(B4 S4)/R4 (Pd4 Jk4)

6. Gn4 Mt4 (Jk4 Pu4)/Jk4 Jr4/C4 Jk4/C4 Jr4/Pu4 Pd4/Jk4 C4 Pu4

7. Gn4 Jr4 Jk4 (B4/Pd4 Mt4)/F4(C4/B4)

8. Gn4 Jk4 Pd4 S4/Mt4/(Mt4 Pu4)/Mt4 Jr4/B4 Jr4

9. Gn4 B4 Jk4/C4/Jk4 F4/C4 M4/M4 Pd4/C4 Pd4

सत्यमेव जयते

Appendix 14.6 (Contd)
Statement - VI (Contd)

Small millets

1. Mt1
2. Mt3 Pd3/Pd4 04/Pd4 Ba4/Pd4 M4/ Pd4 04 Ba4
3. Mt3 Ba4/Ba4(W4/04 Pd4)
4. Mt3 W4 Pu4/Ba4/04 G4/04 Pd4/G4 Jk4
5. Mt4 Pu4(Jr4 C4)/Jk4 B4/Jk4 M4/R4(Gn4/Jk4)/Pd4 Gn4 C4
6. Mt4 B4 Pd4 Jk4 Ch4 /Gn4
7. Mt4 Gn4 Jk4

सत्यमेव जयते

Appendix 14.6 (Contd)

Statement VI (Contd)

Ragi

1. R2 Pd4/Pu4/Pd4 Mt4

2. R3 Pu4 Pd4/L4/Gn4/Jk4/Pd4 Jk4/04

3. R3 Gn4 Pu4/Pd4/Pu4 Pd4/Mt4

4. R3 04 Pd4 M4/Mt4 Pu4

5. R4 Mt4 Pu4 (Jk4 Pd4)/(Jk4 Gn4)/(Pd4 Gn4)

6. R4 Pd4 Mt4/Mt4 04

7. R4 Pu4 Jk4 L4/L4 Pd4/Gn4/Gn4 Pd4/Mt4/Mt4 C4

सत्यमेव जयते

Appendix 14.6 (Contd)
Statement VI (Contd)

Other pulses

1. Pu2 B3

2. Pu3 B3/F3/Jk4 B5 05

3. Pu4 Pd4 G4/M4/W4/R4 Mt4 Gn4

4. Pu4 Jk4 F4/C4 B4/Jk4 Mt4 (B4/R4/Pd4 Gn4)

5. Pu4 Jk4 Jr4 C4 Gn5 05

6. Pu4 Jr4[D4(Gn4 B4)/(Gn4 G4)/(T4 B5)/(Mt4 B4)]/Jk4
(G4/Gn4 T4/G4 Gn4/G4 Mt4 Gn4)/(Mt4 Pd4)

7. Pu4 Gn4 B4 W4/W4 C4 Mt4/Jr4

सत्यमेव जयते

Appendix 14.6 (Contd)
Statement VI (Contd)

Barley

1. Ba2 Pu4/W4

2. Ba3 Mt4 / Mt4 W4

3. Ba4 W4 Pd4 M4 / B4 Pu4

सत्यमेव जयते

Appendix 14.6 (contd)

Statement-VI (Contd)

Fodder

1. F3 O4 M4 / M4 B4
2. F4 M4 W4 Jk4 Gn4

Oilseeds other than groundnut

1. O4 Pu4 W4 F4/Ba4 F4

Fruits

1. Fr3 L4 Pd4
2. Fr4 W4 M4

Tobacco

1. To3 B4 Pd4
2. To4 Mt4 Jr4 F4/Pd4 B4

Potato

1. Pt3 M4 W4

Gram

1. G3 W3/W4/W4 Jk4/Jk4 T4/Jk4 O4/Jk4 Ba4/B4 C4/B4 Jk4/B4 O4/F4/Pd4/Pu4
2. G3 (B4 Pu4)/(B4 F4)(C4 F4)
3. G4 W4 B4 Jk4/Jk4 O4/Jk4 Pu4/Jk4 Ba4/C4/O4
4. G4 W4 O4 Pu4/B4/T4/Jk4
5. G4 W4 Pu4 Pd4/Ba4/M4/Jk4/Pd4(Ba4/M4)
6. G4 W4 Ba4 Pd4/B4/Pd4 B4/Jk4 Pd4/Jk4 B4
7. G4 Pd4 Ba4 B4 / B4 T4

Appendix 14.6 (Contd)

Statement VI (Contd)

Jowar (Kharif)

1. Jk3 Pd4 Mt4

2. Jk3 B4 Gn4/O4 Pu4

3. Jk3 F4 Pu4/C4/Pu4 B4/Pu4 W4/Pu4 M4/Pu4 Gn4/Gn4 C5 M5

4. Jk3 C3/C4 G4/C4 F4 M4/C4 G4 Gn4/C4 F4 W4/C4 Pd4/C4 F4/
C4 Pd4 Gn4/C4 M4/C4 W4/Pu4/C4 Pu4/C4 T4/C4 Gn4 Pu4/
C4 Pu4 B4/C4 O4/C4 Gn4/C4 Mt4 Jr5

5. Jk3 W4 G4/Pu4/O4 G4/C4/F4/C4 F4/M4/G4 B4/B4/Ba4/Ba4 G4

6. Jk3 Gn4/S4/B4 S4/C4/O4/Jr4 Pd4/Jr4 Mt4/R4 Pd4/Pd4 Pu4

7. Jk4 Mt4 W4 O4/G4/O4 G4/O4 Pu4/Pu4 G4/Pu4 T4/Mt4 Pd5/S4 To4/T4
Jk4 Mt4 Gn4/Gn4 B4/Gn4 R4/Gn4 Pu4/Gn4 W4 C4/S4 C4/
B4/B4 C4/B4 Pu4 R4/Pu4 O4/O4/Pd4 Pu4 Gn4/Gn4 C4(Pu4/R4)

8. Jk4 C4 Pd4/Pd4 Gn4/O4 Pd4/O4 Pu4/Pd4 Mt4/O4 Jr4,
Jk4 C4 Gn4 W4/Pu4 B4/Pu4 M4/Pu4 B4 M4
Jk4 C4 Pu4 Gn4 B4/M4/Jr4/W4/Pd4 Jr4

9. Jk4 Pd4(Gn4 Mt4)/(Jr4 O4)/(Pu4 O4)/(Pu4 O4 Mt4/Pu4 R4 O4/
R4 O4

10. Jk4 Pu4 (B4 C4)/Gn4 B4/(Gn4 T5 Jr5)/Gn4/(R5 Gn5 Pd5)/Gn4 B4

11. Jk4 Pu4 O4 W4/Gn4 G5/Gn4 Jr4/Gn4 Jr4 T4/Gn4 B4/B4

12. Jk4 W4 F4(Pu4 Gn4)/(Gn5 Pu5)/(G4 T5)

13. Jk4 W4 M4 Gn4/Pu4/G4/G4 C4

14. Jk4 R4 Gn4 Pd4/Pu4

15. Jk4 Jr4 O4 V4

16. Jk4 Pd4 Mt4 Gn4 C4/Jr4

17. Jk4 B4 Gn4 Pu4 Mt4 Pd4

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Maize

1. M1

2. M2 Pu4/Ba4/Ba4 W4/W5 Mt5/W5 05/Pd4/W4

3. M3 W3/W4 G4
M3 W4 Ba4/Ba4 04/Gn4 04/Gn4 Jk4/Pd4/Pu4/G4 Pd4/G4/
Pu4 04/Pu4 F4/C4 Mt4/C4 04/Jk4 C4/Mt4/Mt4 B4

4. M3 Ba4 Jk4 (B4/C4/Gn4 B4)
C4 (Pu4/04/W4 05)

5. M3 Pu4 Gn4/C4/C4 04/04

6. M3 Pd4 Jk4/Gn4/G4/G4 Gn4/G4 Jk4 C4/Jk4 Mt4/Gn4 B4/Mt4

7. M3 Mt4 Pd4/W4/G4/Ba4

8. M3 C4 04/Jk4 04/04 Jk4 F4

9. M4 Pd4 Pu4/Jk4 04/Jk4 F4/C4 Gn4 04/Jk4 R4

10. M4 Pd4 Mt4 G4/W4/Gn4/B4 C4/B4 Gn4/C4 Gn4/C4 G4

11. M4 Jk4 (Pu4 Pd4)/(C4 F4 Mt4)

12. M4 W4 (Jk4 Ba4)/(Jk4 Ba4 F4)/Jk4 G4/Jk4 04/Jk4 Gn4/G4 F4

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Appendix 14.6 (Contd)

Statement - VI (Contd)

Cotton

1. C1
2. C2 Jk4/B4/Jr4/Pd4 Jr4/F4 Pd4
3. C3 Jk3/Jk4/B4/Jk4 B4/Jk4 W4/Jk4 Pd4/Jk4 Pd4 Gn4/Jk4 Jr4/ B4 Mt4/B4 F4/Jr4
4. C3 Gn4 Jk4/W4/Jr4(W4/Jk4)
5. C3 Pu4 Jk4/B4/Jr4/Gn4/Fr4
6. C3 Pd4 B4/B4 Mt4/Mt4/F4
7. C3 Jr3/Jr4/C3 Jr4 Pd4/Jk4/Mt4/To4/Pd4 To4/B4/B4 Pd4 M4/Pd4 Gn4
8. C4 Gn4 M4 B4/5
9. C4 Gn4 Mt4 Jk4/Pu4 Jk4
10. C4 Pd4 Mt4 Pu4/Jk4 Jr4/Pu4 B4/Gn4 Jk4/Pu4 Jk4
11. C4 Pd4 Pu4 Jk4/(S4)
12. C4 Pd4 Gn4(Mt4 M4)/(Jk4 Fr4)/(Jr4 M5/Jk4)
13. C4 Pu4 Gn4 F4 Mt4/W4 G4
14. C4 Pu4 (Jk4 B4)/(Jk4 Gn4)/(Gn4 B4)/(Gn4 Jr4)/B4 Jr4/Jr4 O4/Jk4 Mt4
15. C4 Jr4 Jk4 B4/Mt4/Pu4/Gn4/Gn4 Pu4/Gn4 Mt4/Pd4 Mt4/ Pu4 B4 Mt4/B4 Mt4/Mt4 O4
16. C4 W4 F4/S4/Jk4 Gn4/Jk4 Gn4 B4

Plantation

1. L2 Pd4
2. L3 Pd3/Ta4 Pd4/Ta4

Appendix 14.6

(Paragraph 14.6.97)

Statement VII - Number of Districts, Geographical and Gross Cropped Area - Statewise

State/ Union Territory	No.of districts	Geographical area(ha)	Average gross cropped area (ha)	Period used for computing average gross cropped area
1. Jammu & Kashmir	10	22,223,600*	832,017	1965-66 to 67-68
2. Himachal Pradesh	10	5,567,300	882,922	1966-67 to 68-69
3. Punjab	11	5,036,200	5,488,066	1968-69 to 70-71
4. Chandigarh	1	11,400	N.A.	-
5. Haryana	7	4,422,200	4,714,864	1967-68 to 69-70
6. Delhi	1	148,500	109,057	1968-69 to 70-71
7. Rajasthan	26	34,221,400	15,059,994	1967-68 to 69-70
8. Uttar Pradesh	54	29,441,300	25,888,152	1968-69 to 70-71
9. Madhya Pradesh	43	44,284,100	20,352,861	1968-69 to 70-71
10. Bihar	17	17,387,600	10,952,399	1967-68 to 69-70
11. Orissa	13	15,584,200	7,445,928	1968-69 to 70-71
12. West Bengal	16	8,785,300	7,002,742	1968-69 to 70-71
13. Arunachal Pradesh	5	8,357,800	54,719	1968-69 to 70-71
14. Assam 9 Meghalaya Mizoram	12	12,209,900	2,958,961	1967-68 to 69-70
15. Nagaland	3	1,652,700	N.A.	-
16. Manipur	5	2,235,600	173,500	1968-69 to 70-71
17. Tripura	3	1,047,700	331,800	1968-69 to 70-71
18. Gujarat	19	19,598,400	10,267,224	1966-67 to 68-69

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Appendix 14.6 (contd)

Statement VII (contd)

State	no.of districts	geographical area(ha)	average gross cropped area (ha)	period used for computing gross cropped area
19. Maharashtra	26	30,776,200	19,333,104	1967-68 to 69-70
20. Dadra & Nagar Haveli	1	49,100	17,056	1968-69 to 1970-71
21. Karnataka	19	19,177,300	10,588,740	1967-68 to 69-70
22. Goa, Daman & Diu	3	381,300	139,177	1968-69 to 70-71
23. Andhra Pradesh	21	27,675,400	13,212,506	1968-69 to 70-71
24. Kerala	10	3,836,400	2,921,222	1968-69 to 70-71
25. Andaman & Nicobar Islands	1	829,300	11,326	1968-69 to 70-71
26. Tamil Nadu	14	13,006,900	7,128,280	1967-68 to 69-70
27. Lakshadweep	1	3,200	2,771	1968-69 to 70-71
28. Pondicherry	4	48,000	49,995	1968-69 to 70-71
All India	356	328,048,300	165,919,383	-

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* Includes an area of 8,411,200 ha under illegal occupation of Pakistan and China.

Appendix 14.6

Statement VIII : District Rainfall Patterns

(paragraph 14.6.97)

1. Rainfall Patterns are based on district normals of monthly rainfall contained in Memoirs of the India Meteorological Department, Vol XXXI, Part 3. The normals of individual stations on which district normals have been worked out are based on all available data during the years 1901 to 1950, with a minimum of five years. The same code which has been used in drawing up rainfall patterns of taluks as explained under 'Methodology' in Section 14.2 above is employed for drawing up district patterns. Briefly stated, monthly rainfall is coded in one of five calsses A to E viz. A is for 30 cm or more, B 20 to 30 cm, C 10 to 20 cm, D 5 to 10 and E less than 5 cm. Numerical subscripts are affixed to the letters A to E to denote the number of months in which the rainfall lies as specified by the concerned letter. For example, A 3 implies rainfall of more than 30 cm pm for three months. The entire years' rainfall is written in coded form in three continuous parts of four months each, for February to May, June to September and October to January. The pattern in each four month period is written in decreasing order and the pattern for June to September is entered in brackets. Reference to Statement I Appendix 14.4 which contains decoded versions according to calender sequence, of rainfall patterns of Zones in the different States, would facilitate writing the monthly sequence in the case of district patterns also.

2. Geographical area: This has been taken from the Census of India 1971.

3. Gross cropped area is the average of three years, generally 1968-69 to 1970-71 and the periods are indicated in the introductory Statement VII for the different States and Territories.

Appendix 14.6

Statement VIII

Jammu and Kashmir

serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Kathua	265,100	86,081	D2 E2 (A2 C1 E1)D1E3
2.	Punch	165,800	(86,601)	C2D2(B2C2) C1D1E2
3.	Rajauri	268,100		
4.	Jammu	316,500	129,701	D2E2(B2C1D1)D1E1
5.	Ladakh	9,537,600	17,355	1. A2B1C1(D4)E2C1E[illegible] 2. C3[illegible](D4)C1D1E2 3. E4 (E4) E4
6.	Baramula	745,800	131,888	C3D1(D3 E1)C1D1E2
7.	Srinagar	301,300	82,867	D4 (D2 E2) D1E3
8.	Anantnag	538,200	148,252	D4(D2E2)D2E2
9.	Doda	1,169,100	64,888	-
10.	Udhampur	454,900	84,384	-
	State total	22,223,600 *	832,017	-

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* Includes an area of 8,411,200 ha under illegal occupation of Pakistan and China.

Appendix 14.6 (Contd.)

Statement VIII (Contd.)

Himachal Pradesh

serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Kangra	839,700	332,049	D2E2 (A2B1C1) D1E3
2.	Sirmur	282,500	70,479	D1E3 (A2B1C1)C1D2 E1
3.	Mandi	401,800	137,067	D3E1 (A2C2) D3 E1
4.	Simla	141,600	45,078	D3 E1 (A2C2) D1 E3
5.	Chamba	819,500	61,211	C1D3 (B2C1D1) C2D1E1
6.	Mahasu	565,200	122,101	D3E1 (B2C1D1) C1D1E2
7.	Bilaspur	116,700	50,672	D1E3 (B2D2) D2 E2
8.	Kulu	543,500	50,476	C2D2 (C2D2) C1D1E2
9.	Kinnaur	655,300	11,215	D4 (D3E1) C1D1 E2
10.	Lahaul & Spiti	1,201,500	2,574	-
	State total	5,567,300	882,922	-

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Appendix 14.6 Contd.

Statement VIII Contd.

Punjab

serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Hoshiarpur	383,300	333,233	E4(D2C1E1)E4
2.	Gurdaspur	356,000	354,336	E4(D2C1E1)E4
3.	Ropar	208,500	182,630	E4(D2C1E1)E4
4.	Ludhiana	385,700	480,235	E4 (C3D1)E4
5.	Patiala	458,300	511,527	E4 (C3D1)E4
6.	Jullundur	339,900	305,305	E4 (C2D1E1)E4
7.	Ferozpur	1,014,500	1,045,067	1. E4(C2D1E1)E4 2. E4(D2E2)E4
8.	Amritsar	508,800	575,554	E4(C2D1E1)E4
9.	Kapurthala	163,300	154,601	E4(C2D1E1)E4
10.	Bhatinda	702,200	829,297	E4(C2D1E1)E4
11.	Sangrur	510,700	635,731	E4(C2D1E1)E4
	State total	5,036,200	5,428,066	

Chandigarh

1.	Chandigarh	11,400		E4(D2C1E1)E4

Appendix 14.6 (Contd.)

Statement VIII (Contd.)

Haryana

serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Ambala	383,300	324,761	E 4 (E2C1E1) E4
2.	Mahendragarh	345,900	405,553	E4 (C3D1/C2D1E1) E
3.	Karnal	806,800	864,326	E 4 (C3E1) E4
4.	Gurgaon	614,600	633,587	E 4 (C3E1) E4
5.	Rohtak	604,300	679,035	E 4 (C2D1E1) E4
6.	Hissar	1,398,200	1,468,197	E 4 (C2D1E1/D3E1) I
7.	Jind	269,100	339,405	E 4 (C2D1E1) E4
	State total	4,422,200	4,714,864	
	Delhi			
1.	Delhi	148,500	109,057	E4 (C3D1) E4

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Appendix 14.6 (Contd.)

Statement VIII (Contd)

Rajasthan

serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Jhalawar	621,600	326,085	E4 (A2C2) E4
2.	Banswara	503,700	245,079	E4 (A1B1C2) E4
3.	Kota	1,243,700	624,060	E4 (A1B1C1D1) E4
4.	Sirohi	513,500	179,643	1) E4 (A1B1D2) E4 2) E4 (C2D1E1) E4
5.	Bharatpur	809,300	634,529	E4 (B2C1D1) E4
6.	Bundi	555,000	251,041	E4 (B2C1D1) E4
7.	Chittaurgarh	1,085,800	398,786	E4 (B2C1D1) E4
8.	Dungarpur	377,000	147,406	E4 (B2C1D1) E4
9.	Sawai Madhopur	1,059,300	552,501	E4 (B2D2) E4
10.	Tonk	720,000	469,154	E4 (B2D2) E4
11.	Bhilwara	1,045,000	367,100	E4 (B2D2) E4
12.	Udaipur	1,726,700	416,934	E4 (B1C2D1) E4
13.	Alwar	838,200	615,299	E4 (C3D1) E4
14.	Ajmer	847,900	422,790	E4 (C2D2) E4
15.	Jaipur	1,400,000	836,773	E4 (C2D1E1) E4
16.	Jalore	1,064,000	588,932	E4 (C2D1E1) E4
17.	Jhunjhunun	592,900	500,491	E4 (C2D1E1) E4
18.	Nagaur	1,771,800	1,174,648	E4 (C2D1E1) E4
19.	Pali	1,239,100	572,615	E4 (C2D1E1) E4
20.	Sikar	773,200	569,811	E4 (C2D1E1) E4
21.	Barmer	2,838,700	930,152	E4 (C1D1E2) E4
22.	Jodhpur	2,286,000	1,057,180	E4 (C1D1E2) E4
23.	Bikaner	2,723,100	503,854	E4 (D2E2) E4
24.	Churu	1,682,900	1,189,901	E4 (D2E2) E4
25.	Ganganagar	2,062,900	1,345,958	E4 (D2E2) E4
26.	Jaisalmer	3,840,100	89,222	E4 (D2E2) E4
	State total	34,221,400	15,059,994	-

Uttar Pradesh

serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Dehradun	308,800	81,261 (d)	1. D2E2 (A2B1C1) E4 2. D2E2 (A2C2) E4
2.	Pilibhit	350,400	282,520	E4 (A2B1C1) E4
3.	Rampur	237,200	271,743	1. E4 (A2B1C1) E4 2. E4 (A1B1C2) E4 3. E4 (B2C1E1) E4
4.	Gorakhpur	631,600	613,724 (d)	E4 (A2B1C1) D1E3
5.	Basti	730,900	769,131	E4 (A2B1C1) D1E3
6.	Nainital	679,200	269,321 (d)	E4 (A2B1C1) E4
7.	Gonda	733,100	730,778 (d)	E4 (A2B1C1) E4
8.	Bahraich	687,100	600,181	E4 (A2B1C1) E4
9.	Varanasi	509,100	465,991 (d)	E4 (A2B1D1) E4
10.	Bareilly	412,500	433,581	E4 (A2C2) E4
11.	Bijnor	485,200	415,941	E4 (A2C2) E4
12.	Mirzapur	1,130,100	428,743 (d)	E4 (A2C2) E4
13.	Garhwal	544,000	-	D3E1 (A2C2) D1E3
14.	Ghazipur	338,100	336,723 (d)	E4 (A1B1C2) E4
15.	Sultanpur	442,400	403,886	E4 (A1B1C1D1) E4
16.	Deoria	540,000	650,408	E4 (B2C1)D1E3
17.	Moradabad	594,600	617,902	E4 (B2C2) E4
18.	Shahjahanpur	458,100	415,933	E4 (B2C2) E4
19.	Ballia	318,300	309,439 (d)	E4 (B2C2) E4
20.	Azamgarh	574,400	548,333	E4 (B2C2) E4
21.	Kheri	769,100	559,876	E4 (B2C2) E4
22.	Faizabad	442,700	414,194	E4 (B2C2) E4
23.	Saharanpur	552,600	532,708	E4 (B2C1D1) E4
24.	Muzaffarnagar	424,500	463,202	E4 (B2C1D1) E4

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Appendix 14.6 (contd.)
Statement VIII (contd.)

Uttar Pradesh (Continued)

serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
25.	Mainpuri	425,400	389,069	E4 (B2C1D1) E4
26.	Etah	444,900	437,955	E4 (B2C1D1) E4
27.	Badaun	515,800	493,569	E4 (B2C1D1) E4
28.	Farrukhabad	434,900	381,155	E4 (B2C1D1) E4
29.	Etawah	432,700	385,950	E4 (B2C1D1) E4
30.	Kanpur	612,100	524,606	E4 (B2C1D1) E4
31.	Fatehpur	416,800	358,858	E4 (B2C1D1) E4
32.	Allahabad	725,500	609,286(d)	E4 (B2C1D1) E4
33.	Jhansi	1,006,900	511,775(d)	E4 (B2C1D1) E4
34.	Jalaun	454,900	379,987	E4 (B2C1D1) E4
35.	Hamirpur	719,200	524,288	E4 (B2C1D1) E4
36.	Banda	764,500	575,970	E4 (B2C1D1) E4
37.	Jaunpur	404,000	382,136	E4 (B2C1D1) E4
38.	Lucknow	252,800	205,272	E4 (B2C1D1) E4
39.	Unnao	458,600	383,759	E4 (B2C1D1) E4
40.	Rai-Bareilly	460,300	374,878(d)	E4 (B2C1D1) E4
41.	Sitapur	573,800	548,336	E4 (B2C1D1) E4
42.	Hardoi	601,200	507,422(d)	E4 (B2C1D1) E4
43.	Pratapgarh	373,000	313,322(d)	E4 (B2C1D1) E4
44.	Barabanki	442,200	420,911	E4 (B2C1D1) E4
45.	Agra	481,600	430,777(d)	E4 (B1C2D1) E4
46.	Meerut	594,400	688,282	E4 (C3D1) E4
47.	Bulandshahr	489,500	556,604 (d)	E4 (C3D1) E4
48.	Aligarh	502,400	577,922	E4 (C3D1) E4
49.	Mathura	379,700	398,094(d)	E4-(C3E1) E4
50.	Almora	702,300	-	-
51.	Tehri-Garhwal	442,100	-	-
52.	Uttar Kashi	801,600	-	-
53.	Chamoli	912,500	-	-
54.	Pithoragarh	721,700	-	-
	hilly region	-	744,216	-
	mixedcrop	-	3,168,184	-
	State total	29,441,300	25,888,152	-

(d) Based on averages for the years 1966-67 to 1968-69

Appendix 14.6 (contd,)
Statement VIII (contd,)

Madhya Pradesh

serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Balaghat	924,500	370,143	E4 (A2B2) DE3
2.	Surguja	2,233,700	583,937	E4 (A2B2) DE3
3.	Raigarh	1,291,000	533,498	E4 (A2B2) DE3
4.	Durg	1,967,000	1,353,234	E4 (A2B2) DE3
5.	Raipur	2,125,100	1,127,941	E4 (A2B2) DE3
6.	Bastar	3,906,000	728,302	E4 (A2B2) DE3
7.	Shahdol	1,402,800	493,561	E4 (A2B1C1) E4
8.	Sehore	901,500	492,762	E4 (A2B1C1) E4
9.	Raisen	839,500	336,246	E4 (A2B1C1) E4
10.	Hoshangabad	1,001,600	440,170	E4 (A2B1C1) E4
11.	Narsinhapur	513,800	277,585	E4 (A2B1C1) E4
12.	Mandla	1,325,700	483,592	E4 (A2B1C1) DE3
13.	Seoni	875, 200	399,337	E4 (A2B1C1) DE3
14.	Guna	1,101,700	538,851	E4 (A2C2) E4
15.	Satna	749,500	385,307	E4 (A2C2) E4
16.	Rewa	631,500	415,062	E4 (A2C2) E4
17.	Sidhi	1,053,200	338,759	E4 (A2C2) E4
18.	Rajgarh	616,300	414,501	E4 (A2C2) E4
19.	Vidisha	743,300	495,710	E4 (A2C2) E4
20.	Sagar	1,024,600	522,841	E4 (A2C2) E4
21.	Damoh	730,100	293,018	E4 (A2C2) E4
22.	Jabalpur	1,016,400	537,438	E4 (A2C2) E4

continued

Appendix 14.6 (contd.)
Statement VIII (contd.)

Madhya Pradesh (continued)

serial number	district	geographical area(hectares)	average gross cropped area (hectares)	rainfall pattern
23.	Chindwara	1,182,400	508,903	E4 (A2C2) D1E3
24.	Bilaspur	1,990,500	930,150	E4 (A2C2) D1E3
25.	Tikamgarh	504,700	257,979	E4(A2C1D1) E4
26.	Chattarpur	869,000	345,527	E4 (A2C1E1) E4
27.	Panna	712,200	218,793	E4 (A2C1E1) E4
28.	Indore	391,000	270,450	E4 (A1B1C2) E4
29.	Dewas	701,400	351,579	E4 (A1B1C2) E4
30.	Shajapur	620,100	370,828	E4 (A1B1C2) E4
31.	Betul	1,006,100	423,149	E4 (A1B1C2) E4
32.	Mandsaur	972,600	572,105	E4 (B2C2) E4
33.	Ratlam	485,900	323,963	E4 (B2C2) E4
34.	Ujjain	608,100	476,640	E4 (E2C2) E4
35.	Jhabua	678,100	354,411	E4 (B2C2) E4
36.	Dhar	814,900	527,102	E4 (B2C2) E4
37.	Morena	1,158,600	416,890	E4 (B2C1E1)E4
38.	Bhind	446,700	342,048	E4 (B2C1E1)E4
39.	Gwalior	521,300	255,600	E4 (B2C1E1) E4
40.	Datia	203,400	130,410	E4 (B2C1E1) E4
41.	Shivpuri	1,028,500	366,539	E4 (B2C1E1) E4
42.	Kharagaon (West Nimar)	1,344,100	652,521	E4 (B1C3) E4
43.	Khandwa (East Nimar)	1,070,500	438,927	E4 (B1C3) E4
	non-reporting areas	-	95,547	-
	State total	44,284,100	20,352,861	-

Appendix 14.6 (contd)

Statement VIII (contd.)

Bihar

serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Gaya	1,234,400	940,808	E4 (A2B2/A2B1C1) E4
2.	Champaran	919,600	879,177	DIE3(A2B2) DIE3
3.	Purnea	1,101,300	910,109	CIE3(A2B2) DIE3
4.	Santhal Parganas	1,412,900	621,939	DIE3 (A2B2) DIE3
5.	Ranchi	1,833,100	789,520	E4 (A2B2) DIE3
6.	Singhbhum	1,344,700	416,960	DIE3 (A2B2) DIE3
7.	Shahabad	1,132,000	1,129,029	E4 (A2B1C1) DIE3/E4
8.	Hazaribagh	1,806,000	403,073	E4 (A2B1C1) DIE 3
9.	Palamau	1,267,700	296,667	E4 (A2B1C1) DIE3
10.	Dhanbad	299,400	96,498	E4/DIE3(A2B1C1)DIE3
11.	Saharsa	583,500	484,171	DIE3(A1B3) DIE3
12.	Saran	695,200	675,936	E4 (A1B2C1) DIE3
13.	Darbhanga	867,900	818,732	DIE3(A1B2C1) DIE3
14.	Monghyr	982,700	646,417	E4 (A1B2C1) DIE3
15.	Muzaffarpur	783,800	805,296	DIE3(B3C1) DIE3
16.	Patna	552,800	643,597	E4 (B2C2) E4
17.	Bhagalpur	565,600	389,470	DIE3 (B2C2) DIE3
	State total	17,387,600	10,952,393	

Appendix 14.6 (contd.)
Statement VIII (contd.)

Orissa

serial number	district	geographical area(hectares)	average gross cropped area(hectares)	rainfall pattern
1.	Balasore	639,400	492,233	C1D1E2(A2B2) C1E3
2.	Bolangir	890,300	576,543	E4 (A2B2)D1E3
3.	Cuttack	1,121,100	982,982	D1E3 (A2B2)C1E3
4.	Dhenkanal	1,082,600	468,087	D1E3 (A2B2) D1E3
5.	Kalahandi	1,183,500	533,702	E4 (A2B2) D1E3
6.	Keonjhar	824,000	309,989	D1E3 (A2B2) C1E3
7.	Koraput	2,702,000	939,007	B2E2 (A2B2) C1E3
8.	Mayurbhanj	1,041,200	452,709	D1E3 (A2B2) C1E3
9.	Phulbhani (Baudh Khondmals)	1,107,000	227,973	D1E3 (A2B2) C1E3
10.	Puri	1,015,900	607,164	D1E3 (A2B2) C1D1E2
11.	Sambalpur	1,757,000	837,700	E4 (A2B2) D1E3
12.	Sundergarh	967,500	309,180	E4 (A2B2) D1E3
13.	Ganjam	1,252,700	708,659	D1E3 (B2C1)C1D1E2
	State total	15,584,200	7,445,928	

Appendix 14.6 (contd.)
Statement VIII (contd.)

West Bengal

serial number	district	geographical area(hectares)	average gross cropped area(hectares)	rainfall pattern
1.	Jalpaiguri	624,500	376,875	A1C1E2(A4) C1E3
2.	Darjeeling	307,500	123,078	B1C1E2(A4) C1E3
3.	Cooch-Behar	338,600	350,346	A1C1E2(A4) C1E3
4.	24 Parganas	1,379,600	778,657	C1D1E2(A2B2)C1E3
5.	Midnapore	1,372,400	1,049,698	C1D1E2(A2B2) C1E3
6.	Hoogly	314,500	308,617	C1D1E2(A2B2)C1E3
7.	Howrah	147,400	106,456	C1D1E2(A2B2)C1E3
8.	Malda	371,300	387,157	C1E3 (A2B2)C1E3
9.	West Dinajpur	520,600	607,916	C1E3 (A2B2)C1E3
10.	Calcutta	10,400	-	C1D1E2(A2B2) C1E3
11.	Bankura	683,100	413,845	D1E3 (A2B1C1)D1E3
12.	Purulia	625,900	302,963	D1E3 (A2B1C1)D1E3
13.	Nadia	392,600	522,113	C1E3 (B3C1)D1E3
14.	Murshidabad	534,100	657,698	C1E3 (B3C1)D1E3
15.	Burdwan	702,800	567,280	C1E3 (B3C1)D1E3
16.	Birbhum	455,000	450,043	C1E3 (B3C1)D1E3
	State total	8,785,300	7,002,742	

APPENDIX 14.6 (contd.)
Statement VIII (contd.)

Arunachal Pradesh

serial number	district	geographical area(hectares)	average gross cropped area(hectares)	rainfall pattern
1.	Kameng	1,372,400		
2.	Subansiri	1,479,700		
3.	Siang	2,372,300		
4.	Lohit	2,442,700		
5.	Tirap	690,700		
	total	8,357,800	54,719	A2C2(A4) C1E3 (Provisional)

Assam(including Meghalaya and Mizoram)

serial number	district	geographical area(hectares)	average gross cropped area(hectares)	rainfall pattern
1.	Cachar	696,200	259,545	A2C1E1 (A4)C1E3
2.	Goalpara	1,035,900	456,536	A1C1E2(A4)C1E3
3.	Lakhimpur	1,279,200	326,439	A1B1C1D1(A4)C1E3
4.	Garo Hills	808,400	94,738	A1C1E2(A4)C1E3
5.	Kamrup	986,300	581,383	A1C1E2(A3B1)D1E3
6.	Darrang	877,500	359,289	B1C1E2(A3B1)C1E3
7.	Nowgong	556,100	319,179	C2D1E1(A3B1)C1E3
8.	Sibsagar	898,900	346,608	B2D1E1(A3B1)C1E3
9.	Mikir Hills	1,033,200	79,437	
10.	North Cachar Hills	489,000		
11.	United Khasi and Jaintia Hills	1,440,500	92,346	
12.	Mizo Hills	2,108,700	43,411	
State total		12,209,900	2,958,961	

Appendix 14.6 (contd.)
Statement VIII (contd.)

serial number	district	geographical area(hectares)	average gross cropped area(hectares)	rainfall pattern
		Nagaland		
1.	Kohima	720,900		
2.	Mokokchung	385,200		
3.	Tuensang	546,600		
	State total	1,652,700	Not available	1.A1B1C1D1(A4)C1E3 2.C2D1E1(B3C1)C1E3
		Manipur		
1.	Manipur North	341,700		
2.	Manipur West	434,400		
3.	Manipur South	458,100		
4.	Manipur Central	560,500		
5.	Manipur East	440,900		
	State total	2,235,600	173,500	B1C1D2(A3B1)C1D1E2
		Tripura		
1.	West Tripura	335,900		
2.	North Tripura	354,100		
3.	South Tripura	357,700		
	State total	1,047,700	331,300	A1C1D1E1(A3B1)C1E3

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Appendix 14.6 (contd.)
Statement VIII (contd.)

Gujarat

serial number	district	geographical area(hectares) (a)	average gross cropped area(hectares) (b)	rainfall pattern
1.	Bulsar(Valsad)	523,800	319,628	E4 (A3B1) E4
2.	The Dangs	168,300	49,873	E4 (A3B1) E4
3.	Surat	774,500	472,416	E4 (A3B1/A2B1C1)E4
4.	Baroda (Vadodara)	778,800	556,468	E4 (A1B1C2) E4
5.	Broach(Bharuch)	904,500	462,085	E4 (A1B1C2) E4
6.	Panch Mahals	886,600	519,845	E4 (A1B1C2) E4
7.	Kaira (Kheda)	719,400	573,452	E4 (A1B1C1D1) E4
8.	Sabarkantha	739,000	496,356	E4 (A1B1C1D1) E4
9.	Junagadh	1,060,700	629,182	E4 (A1C3/B1C1E2)E4
10.	Banaskantha	1,270,200	915,043	E4 (B2D2/C2D1E1)E4
11.	Ahmedabad	870,700	627,873	E4 (B1C1D2) E4
12.	Gandhinagar	64,900	57,144	E4 (B1C1D2) E4
13.	Mahesana	902,700	772,161	E4 (B1C1D2) E4
14.	Amreli	676,000	513,085	E4 (B1C1E2/C1D3)E4
15.	Bhavnagar	1,115,500	630,857	E4(B1C1E2) E4
16.	Jamnagar	1,412,500	620,447	E4 (B1C1E2) E4
17.	Rajkot	1,120,300	762,117	E4 (B1C1E2) E4
18.	Surendranagar	1,048,800	689,410	E4 (B1C1E2) E4
19.	Kutch	4,561,200	599,782	E4 (C1D1E2) E4
	State total	19,593,400	10,267,224	

Appendix 14.6 (contd.)
Statement VIII (contd.)

Maharashtra

Serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Thana	955,300	303,722	E4 (A4) D1E3
2.	Kolaba	719,800	234,920	E4(A4) C1E3
3.	Ratnagiri	1,304,000	373,508	E4(A4) C1E3
4.	Nasik	1,558,200	959,379	1. E4 (A4) C1E3 2. E4 (C4) D1E3
5.	Poona	1,564,000	1,090,300	1. E4 (A4) C1E 3 2. E4 (B1C3) D1E3 3. E4 (C3D1) D1E3 4. E4 (C1D3) D1E3
6.	Satara	1,049,200	746,789	1. E4 (A4) C1E3 2. E4 (A2B2) C1E3 3. E4 (C1D3) D1E3
7.	Kolhapur	805,900	411,942	D1E3(A4/A3B1/A3C1/A2B1C1/A1C3/C1D3)C1E3/D1E3
8.	Greater Bombay	60,300	7,061	E4(A3B1) D1E3
9.	Bhandara	921,400	504,705	E4 (A2B3) E4
10.	Chandrapur	2,564,100	709,448	E4 (A2B2) D1E3
11.	Wardha	630,700	436,238	E4 (A1B1C2)E4
12.	Nagpur	992,800	556,885	E4 (A1B1C2) E4
13.	Nanded	1,049,200	752,712	E4 (B2C2) E4
14.	Yeotmal	1,392,500	809,859	E4 (B2C2/B1C3) E4
15.	Dhulia	1,314,300	742,929	E4 (B1C3) E4
16.	Jalgaon	1,177,100	852,939	E4 (B1C3) E4
17.	Parbhani	1,248,900	998,560	E4 (B1C3) E4
18.	Bhir	1,122,700	819,662	E4 (B1C3) D1E3
19.	Osmanabad	1,411,700	1,123,746	E4 (B1C3) D1E3
20.	Buldhana	974,500	714,674	E4 (B1C3)E4
21.	Akola	1,056,700	804,498	E4 (B1C3) E4
22.	Amraoti	1,221,000	720,675	E4 (B1C3) E4
23.	Aurangabad	1,620,000	1,403,096	E4 (C4) E4
24.	Ahmadnagar	1,703,500	1,329,544	E4 (C2D2) D1E3
25.	Sangli	856,300	654,465	E4 (C2D2) D1E3

Appendix 14.6 (contd.)
Statement VIII (contd.)

Dadra and Nagar Haveli

Serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Dadra & Nagar Haveli	49,100	17,056	E4 (A3B1) E4

Karnataka

Serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	South Kanara	844,100	272,669	C1E3 (A4) B1D1E2
2.	Shinoga	1,054,800	323,472	1. D1E3(A3B1) C1E3 2. D1E3 (A3C1) C1E3 3. D1E3(B1C2D1) C1E3 4. D1E3 (D4) C1E3
3.	Hassan	682,300	328,145	1. C1D1E2(A3B1)C1D1E2 2. C1D3(D4) C1D1E2
4.	North Kanara	1,027,600	124,845	D1E3(A3B1) C1D1E2
5.	Chickmagalur	719,900	231,212	1. D1E3(A3B1)C1[illegible] 2. D1E3(D4)C1D1E2
6.	Dharwar	1,374,900	1,139,295	1. D1E3 [illegible] (B1C3) C1E3 2. D1E3(C2D2) C1E3
7.	Bidar	545,100	413,317	E4(B1C3) D1E3
8.	Belgaum	1,341,000	958,279	D1E3(C4)D1E3
9.	Gulbarga	1,622,400	1,257,151	E4(C4) D1E3
10.	Bangalore	800,300	380,043	D1E3(C2D2)C1D1E2
11.	Kolar	822,300	256,032	D1E3(C2D2)C1D1E2
12.	Raichur	1,400,500	1,046,694	E4 (C2D2) D1E3
13.	Tumkur	1,060,600	481,577	D1E3(C1D3) C1D1E2
14.	Chitradurga	1,085,200	420,043	D1E3(C1D3) D1E3
15.	Bijapur	1,705,600	1,438,485	E4(C1D3) D1E3
16.	Bellary	989,800	604,882	D1E3(C1D3)D1E3
17.	Mandya	495,800	274,226	C1E3(C1D1E2)C1D1E2
18.	Mysore	1,194,700	512,024	C1D1E2(D4)C1D1E2
19.	Coorg	410,400	116,344	-
	State total	19,177,300	10,588,740	

Appendix 14.6 (contd.)
Statement VIII (contd.)

Goa, Daman and Diu

Serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Goa	370,100		E4(A4)C1E3
2.	Daman	7,200		E4(A3B1) E4
3.	Diu	4,000		E4(B1C1E2) E4
	Total	381,300	139,177	
	Andhra Pradesh			
1.	Khammam	1,586,600	456,311	E4(A1B1C2/B1C3)D1E3
2.	Adilabad	1,613,300	590,287	E4 (B2C2) D1E3
3.	Nizamabad	796,900	339,790	E4 (B2C2) E4
4.	East Godavari	1,094,000	541,457	D1E3(B1C3)C1D1E2/ B1D1E2
5.	West Godavari	778,000	538,300	E4(B1C3) C1D1E2
6.	Medak	968,500	488,154	E4(B1C3)D1E3
7.	Warangal	1,287,500	575,896	E4(B1C3) D1E3
8.	Karimnagar	1,182,400	509,762	E4(B1C3) D1E3
9.	Srikakulam	974,300	567,056	D1E3(C4) C1D1E2
10.	Visakhapatnam	1,373,900	526,975	D1E3(C4) C1D1E2
11.	Krishna	873,400	576,[illegible]	E4(C4) C1D1E2
12.	Hyderabad	770,700	372,[illegible]86	E4(C4) D1E3
13.	Guntur	1,137,700	906,451	E4 (C3D1) C1D1E2
14.	Mahboob nagar	1,841,900	1,034,509	E4 (C3D1) D1E3
15.	Nalgonda	1,424,200	826,499	E4 (C3D1) D1E3
16.	Cuddapah	1,535,600	470,078	E4 (C2D2/C1D3)C1D1E2
17.	Chittoor	1,576,300	507,680	D1E3(C2D2) C2E2
18.	Prakasam	1,762,000	688,790	E4 (C1D2E1) C2E2
19.	Nellore	1,305,800	478,400	E4 (C1D2E1) B2E2
20.	Kurnool	1,879,900	1,149,642	E4 (C1D3) D1E3
21.	Anantapur	1,912,500	907,218	D1E3(C1D3) D1E3
	State total	27,675,400	13,212,506	

Appendix 14.6 (contd.)
Statement VIII (contd.)

Kerala

Serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Ernakulam	327,100	277,342	B1C1D1E1 (A4/A3B1) A1B1D1E1
2.	Kottayam	638,900	372,895	B1C1D1E1 (A4/A3B1) A1B1D1E1
3.	Cannanore	570,600	359,104	C1D1E2 (A3B1) B1C1E2
4.	Kohikode	372,900	271,363(e)	B1D1E2 (A3B1) B1C1E2
5.	Malappuram	363,800	252,557(e)	B1D1E2 (A3B1) B1C1E2
6.	Palaghat	440,000	331,299(e)	C1D1E2 (A3B1) B1C1E2
7.	Trichur	303,200	237,575	B1D1E2 (A3B1) B1C1E2
8.	Alleppey	188,400	234,732	B1C1D1E1 (A3B1) A1B1D1E1
9.	Quilon	462,300	346,306	B1C1D1E1 (A3B1) A1B1D1E1
10.	Trivandrum	219,200	238,049	B1C1D1E1 (A1B1C2) A1C1E2
	State total	3,886,400	2,921,222	

Andaman & Nicobar Island

Serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Andaman & Nicobar Islands	829,300	11,326	A1D1E2 (A4) B2C1E1

(e) These figures relate to 1970-71 as comparable data for 1968-69 and 1969-70 for these reorganised districts are not available.

Appendix 14.6 (contd.)
Statement VIII (contd.)

Tamil Nadu

Serial number	district	geographical area (hectares)	average gross cropped area (hectares)	rainfall pattern
1.	Kanyakumari	168,400	113,306	C2D1E1 (B1C1D2) B2D1E1
2.	Chingleput	792,000	427,481	E4 (C2D2) A1B1C1E1 B2C1E1
3.	North Arcot	1,226,500	626,303	D1E3(C2D2) C2D1E1
4.	Salem	864,300	455,153	D1 E3 (C2D2) C1D1E2
5.	Dharmapuri	964,300	451,528	D1E3(C2D2) C1D1E2
6.	South Arcot	1,089,800	698,453	D1E3 (C2D1E1) B2C1E1
7.	Tiruchirapalli	1,429,100	805,163	D1E3 (C2D1E1) C2D1E1
8.	Thanjavar	973,500	848,778	D1E3(C1D1E2) A1B1C1D1 B1C2D1 C3D1
9.	Coimbatore	1,567,300	811,767	D2E2(D2E2/D1E3) C2E2
10.	Madurai	1,262,900	634,574	D2E2 (D2E2) C2D1E1
11.	Ramanathapuram	1,257,800	646,361	D1E3(D2E2) C2D1E1
12.	Tirunelveli	1,143,300	556,830	D1E3(E4) B1C2D1/C2D1E1
13.	Nilgiris	254,900	52,583	-
14.	Madras	12,800	-	-
	State total	13,006,900	7,128,280	-
		Lakshadweep		
1.	Lakshadweep	3,200	2,771	C1E3(A1B2C1) C2D1E1
		Pondicherry		
1.	Pondicherry	29,000		
2.	Karaikal	16,100		
3.	Mahe	900		
4.	Yanam	2,000		
	Total	48,000	49,995	D1E3(C1D1E2)A1B1C1E1

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Appendix 14.7

(Paragraph 14.6.113)

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Statements I to V

Statement I - Rainfall and Cropping Patterns of Orissa State

Appendix 14.7

Statement I. Rainfall and Cropping Patterns of Orissa State

(Paragraph 14.6.11

The National Commission on Agriculture in their working paper on Rainfall and Cropping patterns of Orissa have delineated the State into twelve rainfall zones. The State was divided into nine cropping patterns. The working paper was discussed by the State and O.U.A.T. officials in a meeting where it was decided to collect rainfall data from all the recording stations and group them in the appropriate rainfall zones and examine the efficiency of the existing patterns from the point of view of Agronomic (soil, topography) and economic considerations and to suggest substitution or change on the basis of trials/experiments for different soil types under rainfed conditions as well as under various intensities of irrigation facilities.

In accordance with this discussion the rainfall data in respect of Taluks for which such data was not incorporated in the working paper were collected. Suggested patterns for high, medium and low lands for rainfed and irrigated areas were worked out on the basis of the trials/experiments and successful demonstrations of the patterns and changes which have been accepted by the farmers. As a preliminary exercise the patterns which will be suitable from Agronomic and economic point of view in the different rainfall pattern zones have been worked out and given in the following statements. The crop patterns have been suggested for four types of lands on the basis of their topography viz., very-high, high, medium and low lands for the rainfed areas and for only three types of land viz. high, medium and low for irrigated areas. Further division for irrigation of various intensities, viz-perennial irrigation, two season irrigation, one season irrigation and supplementary irrigation has not been made but for command areas of lift irrigation points, dug-wells, tanks, cross bunds, etc. cropping patterns having low to medium water requirement have been suggested along with heavy duty cropping patterns for the command areas of canals providing perennial irrigation.

The percentage of area to be devoted to each pattern in individual taluks taking into consideration the proportion of high, medium and low lands and texture of soils and irrigation facilities available has not been shown. This will require detailed examination of proportion of different types of land, crops now being grown on these lands, results of trials, demonstrations conducted in each Taluk, farmers' preferences and changes which have already been accepted by the farmers of the area. Such a talukwise study necessarily, will take long time.

The codes and the numerical subscripts used in the statements are the same as adopted in the working paper of the National Commission on Agriculture. Some additions have been made to these codes. The codes and symbols used in the statement are described below:

1. RAINFALL ZONES:

Interval symbol	Rainfall interval cms/month.
A	greater than 30
B	20-30
C	10-20
D	5-10
E	Less than 10, if pattern form starts with symbol A or B and less than 5 if pattern form starts with symbol C, D, or E.

The subscripts 1, 2, 3 & 4 used indicate the number of months receiving the amount of rainfall shown against the interval symbols. The year has been divided into three seasons, February to May, June to September and October to January. The letters and subscripts in each pattern are given for the three seasons respectively, with the central group for June-September entered in brackets. Example—

$C_1\ D_1\ E_2\ \ (D_2\ E_2)\ \ C_1\ D_1\ E_2$

$C_1\ D_1\ E_2$—February to May

$(D_2\ E_2)$—June to September

$C_1\ D_1\ E_2$—October to January.

II. CROPPING PATTERNS:

Crops	Symbols
Paddy	Pd
Fodder	F
Ragi	R
Bajra	[illegible]
Small millets	Mt
Jowar (Kharif)	JK
Maize	M
Gram	G
Tur	T
Other Pulses	Pu
Cotton	C
Groundnut	Gn
Other oilseeds	O
Sugarcane	S
Barley	Ba
Wheat	W
Vegetables	V
Potato	Pt
Other fibres	Fb
Additional Codes:	
Mustard	O (M)
Niger	O (N)

The distribution of crops is shown by subscripts to the symbols.

Subscript	Percentage area
1.	Greater than 70
2.	50-70
3.	30-50
4.	10-30
5.	Less than 10

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III. Suggested Patterns:

In the patterns suggested for different classes of land under rainfed and irrigation, the signs used are:-

+ mixed cropping as for example T + Pd,

/ Alternate crops suggested as for example JK/M/T which means either Jowar, Maize or Tur can be grown.

— One crop following another eg. Pd-Pu paddy followed by pulses.

Red and Yellow soils with black soil patches, undulating topography having several drought prone pockets, general rainfall pattern E4 (A2 B2) D1 E3-150 cms. per year/70 rainy days.
Cropping pattern Pd1 or Pd2, but in Koraput Pd4 Pu4.

Districts Taluks	Rainfall pattern Existing cropping pattern	Soils	Suggested patterns for the zone: Rainfed Areas: Very high land	High land	Medium land	Low land	Irrigated Areas: High land	Medium land	Low land	Remarks
1.	2.	3.	4.	5.	6.	7.	8	9	10.	11.
SUNDERGARH										
1. Sundergarh	E4(B1A2B1)D1E3 Pd1	Red & Yellow	1.JK/M/T/Gn/V. 2.R/Pu/C Pu/O.	1.Pd/M/JK/R/Pu/O/T.	1.Pd-Pu/O. 2.R/O-Pd-Pu/O	1.Gn-Pd-Pu. 2.Fb-Pd-Pu.	1.Pd-W-Pu/O. 2.Pd-O(M)-Pu. 3.Pd-Pu/C/V.	1.Fb-Pd-Pd/Pu. 2.Pd-O(M)-Pd. 3.Pd-W-O. 4.R.Pd V/Pu/O.	1.Gn-Pd-Pd. 2.Fb.Pd-Pd.	• In drought-prone areas no paddy should be grown in very high land. • In black and heavy soil patches on very high and high land cost+groundnut or Pu (green gram) may be grown.
2. Hemgiri		Red		2.Fb-Pu/O.						
3. Panposh		Red	3.T+Pu/R/O	3.T+Pd						
4. Bonai	E3D1(B1A2B1)D1E3 Pd1	Red								
5. Rajgangpur	E4(B1A2B1)D1E3 Pd1	Red								

ZONE-I Contd.

	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
SAMBALPUR										
1. Sambalpur	E4(B1A2B1)D1E3 Pd1	Red & Yellow								
2. Jharsuguda	E4 (B1A2B1)D1E3 Pd1	Red & Yellow								
3. Bargarh	E4(B1A2B1)E4 Pd1 05	Red								
4. Deogarh	E3D1(B1A2B1)C1E3 Pd1	Red								
5. Rairakhol		Red								
6. Padampur	E4(C1A2B1)D1E3 Pd1 05	Black clay loamy.								
7. Kuchinda		-do-								
DHENKANAL										
1. Athmallik	E4(B1A2B1)D1E3 Pd2 Pu4	Red								
PHULBANI										
1. Baudh	E4(B1A2B1)D1E3 Pd1	Red & black								

ZONE- I Contd.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
BOLANGIR										
1. Birmaharajpur		Red								
2. Patnagarh	E4(B1A2B1)D1E3 Pd2Pu4	-do-								
3. Titlagarh	E4 (B1A2B1)D1E3 Pd2 Pu4	-do-								
4. Bolangir	E4 (B1A2B1) D1E3 Pd2Pu4	Red & black								
5. Sonepur	E4(B1A2B1)D1E3 Pd1Pu5	Red & black in patches.								
KALAHANDI										
1. Jaipatna		Red								
2. Nawarangpur	E4(B1A2B1)D1E3 Pd2Pu4	-do-								
3. Kalahandi	E4(B1A2B1)D1E3	Red & black								
4. Dhamramgarh		-do-								
KORAPUT										
Kashipur		Red								

ZONE - II

Clay and red loam soils, plain and low lyingland with saline strips near the coast. Rainfall pattern D1E3(d+)C1D1E2 ; 120 cm./56 days. Cropping pattern Pd2Pu4.

District Taluks	Rainfall pattern Existing cropping pattern	Soils	Suggested cropping patterns for the zone: Rainfed Areas: Very high land	High land	Medium land	Low land	Irrigated Areas: High land	Medium land	Low land	Remark
GANJAM Chhatrapur	E3D1(C3B1)B1D1E2 Pd2Pu4	Clay & Red lam soils	Nil	1. Pd-Pu/0	1. R-Pd-Pu	1. Fb-Pd-Pu/0	1. V-W-V	1. R-Pd V/0/Pu	1. Pd-Pd	
				2. Fb/R-Pu	2. Pd-Pd-Pu	2. Pd-Pu/0	2. R-V-0/V	2. 0-Pd-Pu/V	2. Fb-Pd-Pd	
					3. Pd-Pu/0		3. Pd-P-0	3. Fb-Pd-Pu	3. Pd-V	
							4. Fb-V-V		4. Pd-Pu/0	

Red loam soils with lateritic patches; hilly and undulating terrain, rainfall pattern D1E3(B3C1)C1E 120cm./70 days. Cropping pattern Pd3Pu4Mt4. This zone has more drought-prone pockets

District Taluks	Rainfall pattern Existing cropping pattern	Soils	Suggested cropping patterns for the zone							Remar
			Rainfed Areas				Irrigated Areas			
			Very high land	High land	Medium land	Low land	High land	Medium land	Low land	
KORAPUT Gunupur	E2D2(C1B3)C1E3 Pd3Mt4Pu4	Red loamy with laterite patches	1. JK/M/T/V	1. Pd/M/Jk/R-Pu/O	1. Pd-Pu/O	1. Pd-Pu	1. R/M/V P/V/O-O/V	1. R-Pd-V/Pu	1. Pd-Pu/V	Paddy shoul not be encour ed on rainfe very high land in drou prone areas
			2. R/Pu/O-Pu/O	2. Fb-Pu/O	2. R/O-Pd-Pu	2. Fb-Pd-Pu	2. Pd-P-V/O	2. Pd-W-Pu	2. Fb-Pd-Pu/V	
			3. Mt-O/Pu	3. T+Pd			3. Fb-V/W-Pu	3. Fb-Pd-Pu/O		
			4. T+Pu/R/O	4. C+Pu/O			4. Sugarcane			
							5. Pd/R-C			
Bissam Cuttack	E2D2(C1B1A1B1)D1E3 Pd3O4R4Mt4	-do-								
Rayagada	E2D2(C1B2C1)C1E3 Pd4 R4 C4 Pu4 Mt4	-do-								

ZONE - IV

Red and sandy soils with costal alluvium having lateritic patches and saline strips; Topography plain in the coast and undulating in the interior.

Rainfall pattern $D_1E_3(B_3C_1)C_1D_1E_2$ 120-140 cms.; cropping pattern Pd_2Pu_4.

Districts Taluks	Rainfall pattern Existing cropping pattern	Soils	Suggested patterns for the zone							Remarks
			Rainfed Areas				Irrigated Areas			
			Very high land	High land	Medium land	Low land	High land	Medium land	Low land	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
PHULBANI										
G. Udayagiri	$E_2D_1C_1(C_1B_3)C_1E_3$ $Pd_3C_4Mt_4$	Red	1. JK/M/ R/V 2. T+R/ Pu/Mt 3. Tur-meric 4. R/Pu/ O-Pu/C 5. Mt-C/ Pu	1. Fb/M/ R/Pd- Pu/O 2. T+Pd/ R 3. Fb-Pu/ O	1. Pd- Pu/ C 2. O/ R-Pd- Pu	1. Pd- Pu/ O	1. R/M/ V Pd/ Fb- V/W/ P/O	1. R/O- Pd-V/ Pu 2. Fb-Pd- Pu/O	1. Pd-Pu/ V/O 2. Pd-Pd 3. Fb-Pd- Pd	
GANJAM										
Ghumusar		Red sandy & lateretic soils								

(Zone iv contd.)

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Aska	$\frac{E_2D_2(C_1B_3)C_1D_1E_2}{Pd_3Pu_4}$	Red sandy & lateretic soils								
Digapahandi		-do-								
Chikiti		-do-								
Berhampur	$\frac{E_3D_1(C_2B_2)C_1D_1E_2}{Pd_2Pu_4}$	-do-								
Kodala	$\frac{E_3D_1(C_1B_3)C_1E_3}{Pd_2Pu_4}$	-do-								
Parlakhemundi	$\frac{E_2D_2(C_1B_3)C_1D_1E_2}{Pd_3Pu_4R_4Mt_4}$	-do-								
PURI										
Puri	$\frac{E_3D_1(C_1B_3)C_1D_1E_2}{Pd_2Pu_4}$	Light red sandy soils with deep alluvial patches and saline strips								
Banpur	$\frac{E_3D_1(C_1B_3)C_1D_1E_2}{Pd_1}$	-do-								
Krishna Prasad	$\frac{E_4(C_4)C_1D_1E_2}{Pd_2Pu_4}$	Light sandy soils with saline patches								

ZONE - V

Red and alluvial soils; Terrain level in Jaleswar and Basta and undulating in Nayagarh; rainfall pattern D1E3(B4)C1E3; 135 cms/75 days cropping pattern Pd1 or Pd2Pu4.

Districts Taluks	Rainfall pattern Existing cropping pattern	Soils	Suggested patterns for the zone							Remarks
			Rainfed Areas				Irrigated Areas			
			Very high land	High land	Medium land	Low land	High land	Medium land	Low land	
BALASORE Jaleswar	E3C1 (B4)C1E3 Pd1	Deep alluvial soils.	Nil	1.Pd-W/0/Gn 2.Fb-W/0/Gn	1.Pd-Pu/0 2.Fb-Pu/0 3.Fb-Pd-0/Pu	Pd-Pu/0 Fb-Pd-0/Pu.	Pd-P/V/W-Pu/0	1.Pd-Pd 2.Fb-Pd-Pu/0 3.Pd-Gn/Pu-0	1.Pd-Pd 2.Fb-Pd-Pd. 3.Fb-Pd-Pu/0/V.	
Basta	-Pd1	-do-	Nil							
PURI Nayagarh	E3D1(B4)C1E3 Pd2Pu4	Red & laterite soils with patches of alluvial on the river basins.	1.JK/M/R/Gn 2.T+R/Pd.	1.Pd-Pu/0 2.Pd-W+Pu/0.	1.Pd-Pu/0 2.Pd-W/Pu/0.	1.Pd-Pu/0.	1.Pd/R/MV/W/P-Pu/0	1.Pd-V-0/V 2.Sugarcane 3.Pd-W-Pu 4.Pd-Gn-0	1.Pd-Pd 2.Fb-Pd-Pu/V/0.	

ZONE - VI

Alluvial soils, terrain coastal plain, Rainfall pattern D1B3(A1B3)C1E3;
150 cm./70 days cropping pattern Pd1/F 2Fu4.

District Taluks	Rainfall pattern Existing cropping pattern	Soils	Suggested cropping patterns for the zone: Rainfed Areas: Very high land	Rainfed Areas: High land	Rainfed Areas: Medium land	Rainfed Areas: Low land	Irrigated Areas: High land	Irrigated Areas: Medium land	Irrigated Areas: Low land	Remarks
CUTTACK										
Kujang		Heavy alluvial	Nil	1.Fb/Fd-Fu/O	1.Fd-Fu	1.Fd-Fu	1.Fd/Fb-F/V/O/W-Fu/O/V	1.Fb-Fd-Fu/O/V	1.Fb-Fd-Fd	
				2.Fd-Gn*1	2.Fb-Fd-Fu	2.Fb-Fd-Fu	2.Fd-W-Fu/2*	2.Fu-W-Fu/V	2.Fb-Fd-Fu/O/V	
								3.Fd-Fd*3	3.Fd-Fd	
								4.Fb-Fd-Fd*4		
Ken drapara	E3D1(B1A1B2)C1D1E2 Fd2Fu5Fb4	-do-								
Kanika	E3D1(B1A1B2)B1D1E2 Fd1Fu4	-do-								
Pattamundai	E3D1(B1A1B2)C1D1E2 Fd1Fu5	-do-								
Marasaghai		-do-								
Aul	E3C1(C1A1B2)C1D1E2 Fd2Fu4	-do-								

1. * Recommended forlands on river.
2. * For canal irrigated lands.
3 & 4. *Light duty patterns are for L.I. areas.
Heavy duty patterns are for canal irrigated areas.

ZONE - VII

Red loams, Red and Yellow soils with black and lateritic patches, having undulating terrain, rainfall pattern D1E3(A2B2)D1E3 150 cm. Cropping pattern - Pd1, Pd2C4 (Koraput), Pd3, Pu4 O5 Mt5 R4

Districts Taluks	Rainfall pattern Existing cropping pattern	Soil, type	Suggested patterns for the zone							Remarks
			Rainfed Areas				Irrigated Areas			
			Very High land	High land	Medium land	Low Land	High land	Medium land	Low land	
KEONJHAR Barbil		Eastern 4th Red loamy and rest red & yellow	1.Mt-O/Pu 2.T+Pu/Mt 3.Fb/Gn/Pu/O	1.Mt/JK/R/O/Fb. 2.M/R-O/Pu. 3.Pu/O-Pu/O	Pd-Pu/O	Pd-Pu-O	1.R/Pd-Pu/O/V/P 2.M/R/Pd/JK/P/V/W-Pu/O	1.Pd-W-Pu 2.Pd-V/P-M 3.Pd-O(M)-Pu	1.Fb-Pd-Pu 2.Pd-Gn*	2 crops pattern areas w limited irrigat *In L.I. points
Keonjhar	E3D1(C1A1B2)D1E3 Pd1	-dc-								
Champu Kanjipani	E3D1(B1A2B1)C1E3 Pd1	-do-								
DHENKANAL										
Angul	E3D1(C1A2B1)C1E3 Pd2Mt4	Western half red & yellow eastern half red loamy	1.Mt/JK/Gn/Fb/Pu 2.T+Pu/Mt. 3.C+Gn/Pu.	1.C+Gn/Pu *1 2.T/Fb+Pu/Gn 3.Pd/R/Gn-Pu 4.T/Fb+Pd/R 5.M-O(M) *1	Pd-Pu/O	Pd-Pu-O	1.R/Pd-JK-Pu/O(M)V 2.M/V-P/Gn-O/Pu 3.R/Pd-P/V-Pu/O	1.Pd-W-Pu/O 2.R-Pd-Pu/O 3.Pd-O(M)Pu-Pd.	1.Pd-Pd 2.Fb-Pd-Pu 3.Pd-Gn *2	*1.For h and b soil. *2. In L. point

(Zone - VII Contd.)

1	2	3	4	5	6	7	8	9	10	11
Talcher	E3D1(C1A2B1)D1E3 Pd1Pu5O5	Western half red & yellow eastern half red loamy								
Pallahara	E3D1(B1A2B1)D1E3 Pd1 Pu4									
Dhenkanal	E3D1(B1A2B1)C1E3 Pd1									
Kamakhya-nagar	E3D1(B1A2B1)C1E3 Pd2 Pu4									
KORAPUT										
Koraput	E3D1(B1A2B1)C1E3 Pd4O4R4V4/Mt4Pu4/Mt4Pu5	Red	R/Jk/M Mt/Pu/O	1.Pd/M Jk/R/Fb Pu/O/T 2.T+Pd/ O/Mt 3.Turmeric Ginger, 4.Pu/O- O(N)	1.Pd-Pu/ O 2.R/O- Pd-Pu/ O	1.Gn-Pd- Pu 2.Pd-Pu	1.V/P-W P-V/Pu 2.Pd/R W/V- Pu/O 3.V/M- W/P/V/ Pu.	1.Pd-W- Pu/O 2.R-Pd- Pu/O 3.Pd- O(M)/ Pu-Pd.	1.Pd- Pd* 2.Pd- Pu/ O	* Potato for high altitude above 600 Metres. *Refers to irrigated 'Jhola' land. *For khondmals and Balliguda. O(N) Niger.
Nandapur (Pattangi)	E2D2(B1A2B1)C1E3 R4O4Pd4Mt4	-do-								
Boriguma		-do-								
Kotpad	—	-do-								
Nabarangpur	E3D1(B1A2B1)D1E3 Pd2O4	-do-								
Umerkote		-do-								
PHULBANI										
Khondmals	E3D1(B1A2B1)C1E3 Pd3Pu4O5Mt5	-do-								
Baliguda	E3D1(B1A2B1)D1E3 Pd3O4[illegible]	-do-								

ZONE-VIII

Red loamy lateritic soils with a narrow strip of coastal alluvium, undulating terrain, rainfall pattern 150 cm./77 days.
Cropping pattern Pd_1 , Pd_2 , Pu_4 , Pd_2 O_4 Pu_5.

Dists. Taluks	Rainfall pattern Existing cropping pattern	Soils	Suggested cropping patterns for zone							Rem
				Rainfed Areas			Irrigated Areas			
			Very high land	High land	Medium land	Low land	High land	Medium land	Low land	
MAYURBHANJ										
Karanjia	$\frac{E_3C_1(B_1A_2B_1)C_1\ E_3}{Pd_1}$	Red	Mt/JK/Pu/O/Fb	1.M/Gn/Pu/O-Pu 2.T+Gn/Pu 3.Fb-Pu/O	1.R/O-/Pd-Pu/O 2.Pd-Pu-O 3.Pd-W*	1.Pd/Pu-Oi 2.Fb-Pd-Pu/O	1.Pd-R/W-Pu/O 2.V/M/JK-P/V/O-Pu/O	1.Pd-W/Pu/O/V 2.Fb-Pd-Pu/O 3.R-Pd-Pu/O/V 4.Pd-O(M)-Pd	1.Fb-Pd-Pd 2.Pd-Pd	
Rairangpur	$\frac{E_3D_1(B_1A_2B_1)D_1E_3}{Pd_1}$	Red								
KEONJHAR										
Anandapur	$\frac{E_2D_2(B_1A_1B_2)C_1E_3}{Pd_1}$	Red								
CUTTACK										
Sukinda	$\frac{E_3D_1(B_1A_2B_1)C_1E_3}{Pd_1}$	Red								

Zone - VIII (Contd.

1	2	3	4	5	6	7	8	9	10
Jaipur	$\frac{E_3D_1(B_1A_2B_1)C_1E_3}{Pd_2Pu_4}$	Red loamy except in eastern thired where laterite is the main soil narrow strip of costal alluvial also present.	1.Mt/R/JK/Pu/O	1.Pd-Pu 2.Fb-Pu/O 3.M/Gn/Pu/O	1.Fb-Pd-Pu/O	1.Fb-Pd-Pu 2.Pd-Pd/O	1.Fb/Pd-W/V/P-Pu/O 2.V/Pd-P/V-C/Pu	1.Fb-Pd-Pu 2.Pd-V-V 3.Sugar-cane 4.Fb-Pd-Gn/Pu	1.Pd-Pd 2.Fb-Pd-Gn/Pu 3.Fb-Pd-Pd
Darpani		-do-							
Salepur	$\frac{E_3D_1(C_1A_1B_2)C_1E_3}{Pd_2Pd_4O_4Gn_4}$	-do-							
Cuttack	$\frac{E_3D_1(B_1A_2B_1)C_1E_3}{Pd_2Pu_4}$	-do-							
CUTTACK									
Athgarh	$\frac{E_3D_1(B_1A_2B_1)C_1E_3}{Pd_2Gn_4}$	Red loamy soils cover most of the neighbouring districts to south west.	1.T+R/Gn/Pu 2.Fb/Gn/R/Pu/JK/M.	1.Pd/Gn/R-Pu 2.Fb/R/M/Jk-Pu/O	1.Pd-Pu/O 2.Fb-Pu/O	1.Pd-Pu/O 2.Fb-Pd-Pu/O	1.Pd-V/F/W-V/Pu/O	1.Sugar-cane. 2.Pd-V/W/P-Pu/V 3.Pd-O (M)-Pd 4.Fb-Pd-Pu/O/V.	1.Fb-Pd-Pd 2.Pd-Pu 3.Pd-Pu/O/V/Gn

(Zone viii contd.)

1	2	3	4	5	6	7	8	9	10
Tigiri	E3D1 (B1A2B1)C1E3 Pd1	Red loamy soils cover most of the neighbouring districts to south west							
Baramba	E3D1(B1A2B1)C1E3 Pd2O4	-do-							
Narsingpur	E3D1(B1A2B1)C1E3 Pd2O4Gn4/O4	-do-							
Banki	E3D1(B1A2B1)C1E3 Pd2Pu4	-do-							
DHENKANAL									
Hindol	E3D1(B1A2B1)C1E3 Pd2O4Pu5	-do-							
KALAHANDI									
Lanjigarh	Pd2Pu4	Red							
PURI									
Khandapara	E3D1(B1A2B1)C1E3 Pd2Pu4	-do-							
Dasapalla	E3D1(B1A2B1)C1E3 Pd2Pu4	-do-							

ZONE - IX

Red loamy and coastal alluvium undulating in the inland areas and plain in coastal tract, Rainfall pattern D1 E3 (A2B2) C1 D1 E2 - 150-190 cm./in 70 days; cropping pattern Pd2 Pu4

Districts Taluks	Rainfall pattern Existing cropping pattern	Soils	Suggested cropping patterns for the zone							Remarks
			Rainfed Areas				Irrigated Areas			
			Very high land	High land	Medium land	Low land	High land	Medium land	Low land	
CUTTACK Jagatsinghpur	E3D1(B1A2B1)C1[illegible] Pd2Pu4	Red	Nil	1.M/R/ Pd-Pu. 2.Fb/Gn/ Pd-Pu	1.Pd-Pu/ O.	1.Pd-Pu/ O.	1.M+P/ V-O/ Pu 2.Pd-O Pd.	1.Pd-[illegible] O-Pu. 2.Fb-[illegible] Pu. 3.Pd-Gn.	1.Pd/Gn 2.Pd-Pd 3.Fb-Pd-Pu/O/ V/Gn. 4.Fb-Pd-Pd.	
Niali		-do-								
PURI										
Bhubaneswar	E3D1(B1A2B1)C1D1E2 Pd1	-do-	1.T+R/Pd/ Gn/Pu. 2.Fb/Gn/ V/Pu.							
Ranpur	E3D1(B1A1B2)C1D1E2 Pd2Pu4/Gn/.	-do-								
Nimapara		-do-	Nil							
Pipili	E3D1(B1A3)B1D1E2 Pd2Pu4	-do-	Nil							

ZONE - X

Red loamy soil undulating terrain rainfall pattern D1 E3(A3 B1) D1 E3 160-200 cm, in 90 days crop pattern Pd1/Pd2 R4

District Taluks	Rainfall pattern Existing cropping pattern	Soils	Suggested cropping patterns for the zone							Remarks
			Rainfed Areas				Irrigated Areas			
			Very high land	High land	Medium land	Low land	High land	Medium land	Low land	
KORAPUT										
Matu		Red								
Malkangiri	E4(B1A3)C1E3 / Pd1	Red	1.Jk/Mt/ B/R/ V/O 2.T+Mt/ Pu/R 3.R/T/Fb/ Mt.	1. T+X/ Pu/Pd Mt. 2.R/Pd O/T/ Fb.	1.Pd-Pu/ O.	1.M/R/ Pd-P/V 2.V/M/- V/O- V/Pu.	1.Pd-W/ O-Pu 2.Pd-O Pd		1. Pd-Pd 2. Fb-Pd- Pd 3.Fb-Pd- Pu/V/ O.	
Jeypore	E3D1(B1A3)C1E3 / Pd2 R4	-do-								

ZONE - XI

Red Loamy soil, undulating Table land, rainfall pattern D2, E2(B4)C1D1E2,150Cm/ 80 rainy days, cropping pattern Pd3, Pu3/Pd3 R4

istrict aluks	Rainfall pattern Existing cropping pattern	Soil Type	Suggested patterns for the zone							Remarks
			Rainfed Areas				Irrigated Areas			
			Very high land	High land	Medium land	Low land	High land	Medium land	Low land	
ANJAM										
R.Udayagiri	E2D1C1(B4)C1D1E2 Pd3 Pu4 R4	Red	1.JK/M/T/V/R/Gn/Pu/O 2.T+Pu/R/O	1.Pd/M/JK/R/Pu/O 2.T+Pd/R/Pu/Mt	Pd-Pu/O	Pd-Pu-O	1.R/M/V-P/V/O-Pu/V 2.Pd-P/V-Pu/O	1.R/O-Pd-Pu/O 2.Pd-W-Pu/O 3.Pd-O-Pd	1.Pd-Pu/V/O 2.Fb-Pd-Pd	
Surada	E2D2(B4)C1D1E2 Pd3 Pu4	-do-								

ZONE - XII

Red loam, Red and yellow and alluvial soils, undulating and coastal plain, rainfall pattern C1D1E2 (A2B2) C1E3, 150-200 cm./75-80 rainy days, Cropping pattern Pd1.

District Taluks	Rainfall pattern Existing cropping pattern	Soils	Suggested cropping patterns for the zone							Remarks
			Rainfed Areas				Irrigated Areas			
			Very high land	High land	Medium land	Low land	High land	Medium land	Low land	
BALASORE Chandavali	E2D1C1(C1A2B1)B1D1E2 Pd1	Red loamy except in such west where it is deltaic alluvial.								
Dharmagar		-do-	Nil	Fb/Pd/Pu/ M/V/R	Pd-Pu/O	1.Fb-Pd-Pu/O 2.Fb-O/Pu.*1 3.Pd-Pu/O	1.V/Pd-W/V-Pu/O 2.Pd-C *2	1.Pd-Pu-Pd 2.Pd-W-Pu/V. 3.Sugar cane	1.Pd-Pd 2.Fb-Pd-Pu/V 3.Fb-Pd	*1 Flooded areas. *2 In saline belts and soils richer in silt content.
Bhadrak	E2D1C1(B1A2B1)C1E3 Pd1	-do-								
Soro	E3D1(B1A3)B1E3 Pd1	-do-								
Balasore	E2D2 (B1A2B1)C1E3 Pd1	-do-								
Nilgiri	E2D1C1(B1A2B1)C1E3 Pd1	-do-								

(Zone xii contd.)

1	2	3	4	5	6	7	8	9	10	11
MAYURBHANJ										
Betanati		Red	1.JK/T/M/Pu/R/V 2.T+Pu/R/Mt	Pd/Fb/M/V/Pu	Pd-Pu/O	1.Pd-Pu/O 2.Fb-Pd-Pu	Pd/V/M-P/W/V	Pd-W-Pu/V	1.Pd-Pd 2.Fb-Pd-Pu/V	
Udala		Red								

Appendix 14.7

(Paragraph 14.6.114)

Statement II Agro Climatic Zones and recommended Cropping Patterns - Kerala (Selected examples)

Zone	Valley			Slope				Hill top	
	Autumn (Virippu)	Winter (Mundakan)	Summer (Punja)	Seasonal	Annual	Perennial	Intercrop	Perennial	Intercrop
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
				Winter Sesamum ..	...	Pineapple	..	..	..
				Horsegram	...	Lemongrass	..	..	..
V. (Northern Midland)	Rice	Rice	1. Vegetable (cucurbits) 2. Pulses (cowpea)	Autumn Upland Rice (Chennellu)	Banana	Arecanut	Pepper Nutmeg	Cashewnut	Fodder grass
				Winter and Summer	Ginger		Plantains		
					Tapioca		Fodder grass		
				Vegetables		Coconut	Pulses Tapioca Nutmeg		
VI (Northern Midland) Malappuran (Type)	Rice	Rice	Pulses (Cowpea)						
	Banana	Banana	Vegetables (Cocurbits)						
	Vegetables	Vegetables	Vegetables Vegetables	Vegetables	Banana Ginger Tapioca	Arecanut Coconut	Pepper Plantain Nutmeg	Cashewnut	Tapioca with SCP Fodder grass Pineapple

Appendix 14.7 (contd)
Statement - II (contd)

Zone	Valley			Slope				Hill top	
	Autumn (Virippu)	Winter (Mundakan)	Summer (Punja)	Seasonal	Annual	Perennial	Intercrops	Perennial	Intercrop.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
XI Kuttanad Koleland and Kari	Fallow Kulapala (Upper Kuttanad)	Rice	Rice	-.	..	Coconut	1. Plantain 2. Minor (tubers) Colocasia	Only built up garden lands are found.	
XII River bank Alluvium	Rice -Sugarcane-	Rice	1. Rice (Irri.) 2. Pulses Cowpea) 3. Sesamum	Autumn Upland rice Winter Pulses Sesamum	Sugarcane	Arecanut Coconut	Plantain Tapioca Arecanut	Uplands are of mild gradients that it is hardly distinguishable into slope and hill top	
XIII High ranges	Rice Millets	Rice. Vegetables Wheat Oats	Vegetables	Autumn Millets Groundnut Winter Potato (SCP) Wheat Sesamum.	Sugarcane	Coffee Tea Cardamom Orange Fruits	..	Coffee Tea Orange Cardamom Grassland	...

Appendix 14.7

(Paragraph 14.6.115)

Statement III - Suggested cropping patterns for Assam

1. Rice Belt (non flood affected areas)
A. Under Rainfed conditions:

Type of soil	Summer	Kharif	Rabi
(a) Low land	Rice: Varieties:Ch-63 Direct seeding :Early April Harvesting middle July	Rice: Monohar Sali Transplanting Early August Harvesting: End of November.	Wheat: December to March
(b) Medium land	Rice: Variety, Pusa 2-21 Direct Seeding: Early April. Harvesting: Early July	Rice: 'IR 8'/Jaya' Transplanting: Late July to middle of August Harvesting: Early to Middle of November	Wheat· Sonalika Seeding:Late Nove Harvesting:Middle
(c) Upland	Rice: Variety, Pusa 2-21 Direct Seeding:Early April Harvesting:Middle of July	Pusa 2-21 (Direct Seeding) Late July - Middle of November.	Potato/Mustard Late November - Middle of March
B. Under irrigated condition			
(a) Low land	Rice: 'Ch-63' Transplanting: During April Harvesting: During July	Rice: 'Monohar Sali' Transplanting: August Harvesting: Late November	Wheat:(Early December -
(b) Medium to high land	Rice: Pusa - 2-21 Transplanting: April Harvesting: June to July	Rice:'Ir-8'/Jaya' Transplanting: July to August Harvesting:November	Wheat/Potato/Mustard ([illegible]

Appandix 14.7 (Contd)
Statement-III (Contd)

2. Jute Belt
A. Under Rainfed condition

(a) Low land	Jute(Capsularies):'JR O-212' Sowing: March - April Harvesting: end July	Paddy: Monohar Sali' Transplanting:Early August Harvesting: End November	Wheat (December-March)
(b) Medium land	Jute (Olitorius)JRO-7835' Sowing: April-Mid-May Harvesting: End July	Paddy: IR-8'/'Jaya' Transplanting: upto middle August	Wheat/Potato Late November-March
(c) High land	Jute (Olitorius): 'JRO-7835' Sowing: April-Mid May Harvesting: End of July	Pulses: Green Gram Varieties: 'T-51'/Jalgaon 781' Sowing: End August to September. Harvesting: October/ Early November	Potato/Mustard (Middle of November- March middle)

3. Flood affected areas

(A) Under rainfed condition — After flood(From September,

(a) Medium (a) Pulse: Green Gram
September to middle of November
varieties: 'T-51:/Jalgaon-781'/T-44

(b) Mustard/Potato/Wheat(From End-Nov.-March)

(b) Low land (a) Rice' Monohar Sali' Transplanting of order seedling of 50-days and with closer spacing.
Transplanting: Upto middle of Sept.
Harvesting: Early Dec.

(B) Under irrigated condition

(a) Low land (a) Rice: Monohar Sali (Middle of Sept. to Early December).
(b) Rice: CH63(Transplated:March/Harvesting:Early June.

(b) Medium & High land (a) Pulse: Green gram(Sept. November)
(b) Potato (November-February).
(c) Rice: Pusa 2-21/Ch---63 (transplated - March - May).

Appendix 14.7

Statement IV - Suggested Cropping Patterns for Maharashtra & Examples

(Paragraph 14.6.116)

Zone No.I: This zone has 18 talukas in 6 districts as given below:

The total area exceeds 20,000 sq. Kilometers.

District	Taluka
1. Sangli	1. Miraj 2. Tasgaon 3. Jath 4. Islampur 5. Vita (Khanapur)
2. Sat	6. Vaduj 7. Dahiwadi
3. Poona	8. Baramati 9. Phaltan 10. Dhond 11. Indapur
4. Sholapur	12. Karmala
5. Ahmadnagar	13. Shrigonda
6. Sholapur	14. Pandharpur 15. Sangola 16. Mangalwedha 17. Malsiras 18. Madha

The above area is in the scarcity zone

II. Annual Rainfall: Rainfall (Annual) of this zone is between 45 to 65 cms., but 2/3rd of the zone receives rainfall less than 55 cms. Talukas of Sangli, Islampur, Tasgaon and Miraj have average higher than 60 cm. The normal distribution of the rainfall in pre-monsoon, monsoon and post-monsoon period is as under:-

Pre-monsoon	Monsoon	Post-monsoon
Feb. to May Less than 5 cmpm	June to Aug. 5 to 10 cmpm. Sept. 10 to 20 cmpm.	Oct. 5 to 10 cmpm Nov. to Jan. Less than 5 cmpm

June to September receives about 75 per cent of the annual rainfall. Monthly rainfall particularly of July to August is highly variable compared to September showers.

III **Soils:** The zone has light to medium soils on an average though some area has deep soils on banks of river flowing

IV Existing Cropping Pattern: Rabi jowar is predominant in medium and heavy soils while Bajra is predominant in shallow soils. Kharif jowar is grown on large scale in Miraj and Tasgaon talukas of Sangli district. From the rainfall data it is seen that in July and August the area receives fairly good showers. Other crops grown are pulses and groundnut.

V Remarks of the Commission: The rainfall in this zone can support only crops like jowar and bajra but the crops cannot be satisfactory without irrigation. This is because of the highly uncertain character of the rainfall.

VI Changes suggested in the crop pattern

Considering the rainfall behaviour, soils and existing cropping pattern suggestions are offered for changing or adjusting the sowing period of the crops grown. Such changes suggested are indicated in the following table:

Soil type	When the onset of monsoon is early to normal and sowings are possible in June	Late by 3-4 weeks and sowings are in latter half of July	very late and sowings are delayed till middle of August
1. Shallow soils	Bajra, HB3, pulses, cowpea/ sunflower, til-sesamum	Hy. Bajra, Sunflower	Hy. Bajra
2. Medium & Medium deep soils	i) Hy. Bajra HB 3 ii) Hy. Jowar CSH4 or CSH5 iii) Groundnut (early varieties) In rabi season follow on crop of safflower, gram may be taken after Hy.bajra or jowar on the residuary moisture available.		

It may further be added that evolving early varieties of groundnut will help to increase the area under groundnut in this area . Til crop may also be tried in this zone in shallow soils as it requires less water for its growing period and it also thrives fairly well in shallow soils.

In this zone much emphasis is necessary on conservation of moisture by adopting various water harvesting measures. Similarly, priority for increasing irrigation potential has to be given because of the uncertainty of the monsoon rains.

Zone No.IV: This zone has 34 talukas in 6 districts. Particulars are as below:-

District	Taluka
Osmanabad	1. Osmanabad
	2. Tuljapur
	3. Udgir
	4. Ahmedpur
	5. Latur
	6. Ausa
	7. Kallam
	8. Lahora(Omerga)
	9. Nilanga
	10. Bhum
	11. Paranda
2. Sholapur	12. Akalkot
	13. Sholapur
	14. Mohol
	15. Barsi
3. Bhir	16. Bhir
	17. Kaij
	18. Ambejogai
	19. Georai
	20. Manjilegaon
	21. Patoda
	22. Ashti

4. Aurangabad	23. Aurangabad
	24. Paithan
	25. Gangapur
	26. Khuldabad
	27. Saogaon
5. Jalgaon	28. Pachora
	29. Parola
	30. Amalner
	31. Chilisgaon
6. Dhulia	32. Sindhkheda
	33. Dhulia
	34. Nandurbar

Total area of the zone is about 45,000 sq km

The elevation is between 600 to 900 metres above sea level.

II Annual Rainfall: The rainfall in this area is 60 to 70 cm. About 75 per cent of the annual rainfall occurs in the months of June to September.

There is practically no rain before June except very few anti-monsoon showers. In Sholapur and Bhir area the month of maximum rainfall is September while in Jalgaon and Dhulia July is the month of highest rainfall. The main feature in this zone is that all the months i.e. June to September gets on an average 10 cm. or more rainfall per month.

The distribution of rainfall is as below:

Pre-monsoon	Monsoon	Post-monsoon
Feb. to May .. Less than 5 cmpm.	June to Sept... 10 to 20 cmpm.	Oct. to Jan.. Less than 5 cmpm.

III Soils: In the entire area, the soils are mostly medium black with patches of deep black soils. In some talukas of Aurangabad and also Bhir, shallow black soils are also present.

IV **Existing Cropping Patterns:** Cropping patterns in this zone are numerous. The most significant is the jowar crop which is a predominant crop of this zone. A few talukas have Bajra as a dominant crop and Jalgaon and Aurangabad have two patterns with cotton as a dominant crop. In all the patterns pulses (except Gram and Tur) are to be the extent of about 10 per cent.

V **Changes suggested in the cropping pattern:** Low yield of Kharif jowar in Osmanabad, Bhir and Aurangabad districts is partly due to cultivation of jowar even on shallow black soils and partly due to less intensive cultivation methods adopted in these districts and especially the use of fertilisers. Groundnut yields are also low because its cultivation is not restricted to suitable areas only but being a cash crop it is cultivated even in shallow soils. Sometimes September rains fall which is also responsible for reducing the yield.

Following suggestions are offered:

(1) In shallow deep lands cultivation of Hybrid Bajra should be undertaken.

(2) Converage of part of area of Jowar by Hy.varieties should be encouraged. If the rainfall is received in early July conditions are favourable for kharif jowar sowing and should be taken up on extensive scale. Rabi jowar sowing should be taken up in the middle of August for getting maximum advantage of September rains for the grand growth period of the crop. Reduction of area under Tur in

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Tuljapur, Osmanabad and Georai, Manjilegaon of Bhir district by expanding Mung and Urid area which are short duration is recommended. In rabi, a second crop of jowar is to be taken in medium deep soil after the pulse crop in the Kharif season. For some areas, safflower as a second crop may also be tried. Replacement of part of the area of groundnut by sunflower is a short duration crop and which thrives better in less moisture conditions is recommended.

V) For increasing cotton yields it should be taken up in medium deep soils and its cultivation in marginal lands should be discouraged. American cotton varieties like Buri 147, 1007 and Hy 4 may be introduced in place of Arborium varieties. Part of the area may be diverted to chilli crop. Application of fertilisers should be encouraged for getting better yields.

N.B.: It is necessary to evolve short duration high yielding varieties of Tur and Groundnut as these crops cannot be replaced to a significant scale by other varieties of crops.

Zone No.VI: This is the biggest zone with 37 talukas in 9 districts of the State as below:

District	Taluk
1. Nanded	1. Kandahar
2. Patheni	2. Basmat
	3. Jintur
	4. Partur
	5. Hingoli
	6. Parthri
3. Buldhana	7. Chikli
	8. Mekhar
	9. Malkapur
	10. Khamgaon
4. Jalgaon	11. Jalgaon
	12. Chopda
	13. Jamner
	14. Bhadgaon
	15. Erandol
	16. Yaval
	17. Baver
	18. Pachora
5. Aurangabad	19. Ambad
	20. Jalna
	21. Jeffarabad
	22. Behradi
6. Akola	23. Akot
	24. Akola
	25. Balapur
	26. Mangrulpir
7. Yeotmal	27. Pusad
	28. Darwha
8. Amraoti	29. Amraoti
	30. Chandpur
	31. Achalpur
	32. Daryapur
	33. Chikalda
9. Dhulia	34. Shirpur
	35. Shahada
	36. Taloda
	37. Akrani

The total area of this zone is 60,000 sq kms Most of the zone has elevation ranging between 300 to 1600 metres above sea level. Terrain is a rolling plain. Some area is hilly. This zone falls in assured rainfall zone with mainly kharif crop.

II Annual rainfall: July is the highest rainfall month with 20 to 25 cmpm. June, August and September are of the same order - 12 to 18 cmpm. Rainfall in other months is negligible. More than 80 per cent of annual rainfall occurs during the monsoon period.

The distribution of rainfall is as under:-

Pre-monsoon	Monsoon	Post-monsoon
Feb.to May -Less than 5 cmpm.	June, Aug.Sept.- 10 to 20 cmpm.	Oct. to Jan.- Less than 5 cmpm
	July -20 to 30 cmpm.	

III Soils: This zone has mainly medium black soils.

Existing Cropping Patterns: Cotton is the predominant crop while the second important crop is jowar. In fact cotton and jowar are the two common factors in the cropping structure of this zone.

Changes suggested in cropping pattern: The zone falls in assured rainfall area. For increasing the yield of cotton the cultivation of hirsutum varieties like Buri 147, 1007, Hy.4, MCU5 etc. need to be extended in place of Arbarium varieties which are taken at present even in deep soils. Further it is necessary to discourage cultivation of cotton on marginal lands. Such lands be diverted to hybrid Bajra and Hy.Jowar.

(ii) For increasing the jowar yield replacing about 50 per cent of the area under the existing jowar varieties by hybrid varieties like CSH1, CSH4, etc. is recommended. Use of fertilisers should also be boosted up.

Cultivation of improved varieties of pulses, (Urid Mung) is recommended for increasing the yield of pulses. The second crop after pulses like rabi jowar should be encouraged.

Crop of un-irrigated chillies can be introduced in heavy soils.

N.B.: It is necessary to evolve high yielding varieties of pulses and also short duration varieties of Tur for this zone.

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Appendix 14.7

(Paragraph 14.6.119)

Statement V - Suggested Cropping Patterns for Karnataka (Selected examples)

(i) Rainfall Pattern No.XXI - C1 E3 (A4) C1 D1 E2 -Zone

This rainfall pattern covers the coastal taluka of Udipi, Coondapur, Mangalore and Bantwal of South Kanara District. The total rainfall is 3564 mm, distributed mostly from May to November. About 200 to 280 cm rainfall is received during the months of June to July with 51 to 54 rainy days. In this rainfall pattern, 10 to 20 cm rainfall is received during May, compared to 5 to 10 cm in patterns No.XV and XVII. In view of heavy rainfall, paddy is the most important crop in monsoon. Irrigation potential is 46 per cent in Bantwal, 36 per cent in Udipi, 32 per cent in Mangalore and 18 per cent in Coondapur taluk. The irrigation is mostly through tanks, wells and lifts on rivers. The soils are mostly coastal alluvium in all the taluks except some laterites occurring in Mangalore.

The existing cropping pattern for this region is paddy in 70 per cent, plantation crops in 9 to 15 per cent, pulses 4 to 5 per cent, sugarcane 1 to 2 per cent and fodder crops 1 to 3 per cent.

In view of increased irrigation resources and extended crop growing period, it is a common practice to take 2 crops of paddy with supplementary irrigation. Where irrigation is assured, a third crop of paddy or other crops having lower water requirements are also

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Appendix 14.7 contd.
Statement V contd.

to be taken. The research work on multiple cropping conducted at Mangalore indicated that it is possible to grow crops like cowpea, ragi and paddy profitably in summer. The other crops which could be tried are groundnut and pulses.

The average yields of paddy can be increased from 13.5 q/ha to about 25 q/ha by adoption of high yielding varieties, application of adequate fertilisers and adoption of plant protection measures, as there is gallfly menace during monsoon in this area. The results of experiments conducted at the Medium Research Station, Mangalore, have indicated that an average yield of 5,000 Kg/ha can be obtained from high yielding varieties by adopting recommended practices. The yields of second crop can be further enhanced in view of lesser incidence of pests. The important plantation crops in this region are coconut, arecanut, cashewnut, pineapple and pepper. The yields of plantations crops can also be considerably increased by adoption of recommended practices. The results of simple fertiliser trials in cultivators fields have indicated that increase in yield by 11 to 52 per cent can be obtained by application of manures and fertilisers in case of arecanut. There is also experimental evidence to indicate that application of lime increases the yield of arecanut by about 16 per cent over application of

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NPK alone. The results of experiments carried at Kasargod indicate that the yields of coconut can be increased by about 30 per cent by application of manures and fertilizers.

There are large areas of fallow lands ranging from 4 to 8 per cent and cultivable wastes ranging from 7 to 18 per cent in this region. At least a part of this land could be brought under crops like cashew, pineapple, mango and banana. It is further recommended that fodder crops like Napier Grass (Hybrid-2) and Elephant grass should be extended round about cities in fallow and waste lands and river beds which would also serve the purpose of controlling soil erosion.

The recommended cropping pattern in this region will be paddy in 68 per cent, plantation crops in 20 per cent, pulses 9 per cent, groundnut 10 per cent, fodder crops 5 per cent, vegetables 12 per cent and sugarcane 1 per cent.

(ii). Rainfall Pattern Zone No.XXVI - C1 D1 E2 (A.4) C1 D1 E2

This rainfall pattern covers ½ western part of Virajpet and whole of Mercara taluk of Coorg District. The total rainfall received is more than 297 cm distributed mostly from April to November. July is the month of highest rainfall.

The soils are red loams. The existing cropping pattern is paddy in 33 to 45 per cent, cardamom 1 to 2 per cent, citrus 5 to 13 per cent, coffee 30 to 40 per cent and other horticultural crops in 6 to 20 per cent area. The total area under plantation crops is 39 per cent in Virajpet and 57 per cent in Mercara.

The irrigation potential is 6 per cent in Virajpet and 3 per cent in Mercara, mostly from small tanks and canals. Since the heavy rainfall is extending upto the end of September, paddy is the important crop in monsoon season. In uplands, an early duration pulse crop can be sown after the harvest of paddy during the early part of October and November. In about 30 to 40 per cent of the area under plantations, inter-crops like pepper, mandrin and citrus can be grown. In this region, there is possibility of increasing the area under rubber, cocoa, nutmeg, vanilla, cloves, turmeric and ginger. The area under coconut, pineapple, banana, jack fruit, cardamom and citrus could also be increased. New crop that can be introduced is tapioca. Parts of the areas under cultivable waste and fallows can be brought under plantation and forage crops.

The recommended cropping pattern for this region is coffee in 32 to 40 per cent, paddy in 32 to 35 per cent, cardamom in 10 per cent, citrus in 20 per cent and other new plantation crops and spices suggested can cover upto 10 per cent.

(iii) Rainfall Pattern No.III - E4 (C4) D1 E3

This rainfall pattern covers the taluks of Seram, Chincholi, Gulberga, Aland, Afzalpur, Andala and Chittapur. The average annual rainfall is 803 mm mostly distributed from June to September. September is the month of highest rainfall.

The soils are medium to deep black, except in Aland, where some laterites occur. The existing cropping pattern is rabi jowar 30 to 50 per cent, bajra, groundnut, tur and other oilseeds 10 to 30 per cent each. The yields of jowar are about 110 per cent of national average and 80 per cent of State average. The yields of bajra and groundnut are 123 and 99 per cent respectively of national average. The high yields are mostly due to better distributed rainfall.

The irrigation potential in this area is 1 to 2 per cent, except in Andala (Jewargi), where it is 4 per cent. Irrigation is mostly through wells.

It is possible to take an early duration kharif crop of pulses, groundnut or bajra, followed by a rabi crop of jowar, wheat or safflower in moisture retentive soils. Mixtures of hybrid jowar and cotton, cotton-onion, cotton and chilly, groundnut and cotton could also be exploited. Use of adequate fertilizers would increase the crop yields by about 40 to 50 per cent.

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Appendix 14.7 contd.
Statement V contd.

The suggested cropping pattern is paddy 1 per cent, kharif jowar 2 per cent, rabi jowar 28 per cent, bajra 9 per cent, wheat 3 per cent, small millets 2 per cent, gram 4 per cent, tur 12 per cent, other pulses 8 per cent, groundnut 9 per cent, other oilseeds 11 per cent and cotton 7 per cent.

(iv) Rainfall Pattern - Zone No. VII - D1E3(C1D3)C1D1E2

This rainfall pattern covers Hoskote Taluk of Bangalore District, Malur, Bangarpet, Mulbagal, Srinivaspur, Chintamani, Bagepalli, Gudbanda, Gowribidanur and Kolar Taluks of Kolar District; Madhugiri, Koratagere, Sira, Chikkanayakanahalli, Pavagada Taluks of Tumkur District; Hosadurga, Kolakere, Chitradurga, Harihar, Davangere, Jagalur and Molakalmur of Chitradurga District.

This area receives a total average rainfall of 664 mm, ranging from 545 to 763 mm. September and October receive rainfall, ranging from 10 to 20 cm, while in the remaining months of May to November, the rainfall ranges from 5 to 10 cm.

The soils are mostly red sandy, except red loams in the taluks of Chitradurga, Chikkanaakananalli, Koratagere, Madhugiri, Srinivaspur, Mulbagal, Bagepalli, Pavagada and Sira; laterites in the taluks of Malure, Hoskote, Chintamani; laterites and loamy if Kolar, Bangarpet, ½N of Gowribidanur, mixed red and black in Holakere and Hosadurga and deep black in Davangere, Harihar and Jagalur.

The existing cropping pattern is ragi in 50 to 70 per cent, paddy 10 to 20 per cent, groundnut 10 to 20 per cent and pulses 10 to 20 per cent in Kolar District. In Chikkanayakanahalli of Tumkur District and Hosadurga of Chitradurga District, plantation crops occur in 21 and 18 per cent area respectively. In Chitradurga District, ragi is grown to an extent of 10 to 30 per cent, Kharif jowar 10 to 30 per cent and paddy 10 to 30 per cent. In Molakalmur and Challakere Taluks, pulses and small millets occur in 10 to 30 per cent area.

The yield levels of jowar, paddy and ragi are more than national average. Groundnut yields are near about the national average, but the cotton yields are low. Ragi crop needs to be continued, but the yields can be increased considerably by application of adequate fertilizers and growing short duration varieties like Purna and Sharada. If the early rains fall, it is better to sow ragi or sunflower in place of groundnut. Cowpea is a suitable for dryland and its use needs to be exploited. Castor is an important crop which can be introduced in this area. The yields of RE 1377 (S.A.2) have been recorded to an extent of 12 Q/ha.

About 21 per cent of the area has irrigation facilities. Parts of Harihar and Davangere receive irrigation through Bhadra project, while other taluks have irrigation mostly through tanks and wells. 50 to 60 per cent of the area in Harihar and Davangere is irrigated. Irrigation potential is between 20 to 35 per cent in the taluks of Kolar, Malur, Kortagere, Madhugiri, Bangarpet, Sirinivaspur, Mulabagal, Gowribidanpur and Sira. 10 to 20 per cent of the area is irrigated in the taluks of Hoskote, Chintamani, Bagepalli and Pavagada.

The cropping pattern for the irrigated areas may be recommended as under:

1. Hybrid jowar – Wheat – Hybrid jowar or bajra or ragi
2. Hybrid maize – Wheat or Bengalgram – Hybrid jowar or bajra or ragi.
3. Ragi – Bengalgram or wheat or maize or vegetables – Hybrid bajra or ragi or groundnut
4. Ragi-Wheat – Maize – Beans
5. Maize – Wheat – Ragi-Leafy vegetables
6. Hybrid jowar – Radish – Beans or Peas – Hybrid bajra
7. Ragi-beans – Potato – Maize
8. Paddy – Wheat – Maize or jowar or bajra or groundnut
9. Paddy – Beans or vegetables – Paddy

Paddy may be restricted to low-lying areas only. The above cropping pattern may be followed depending upon the locality, soil type and water for irrigation.

The average recommended cropping pattern for the taluks under Chitradurga district is paddy 8 per cent, kharif jowar 20 per cent, rabi jowar 2.5 per cent, ragi 17 per cent, bajra 1 per cent, small millets 9 per cent, tur 6 per cent, sugarcane 0.2 per cent, other pulses 12 per cent, groundnut 7 per cent, cotton 4 per cent, sunflower 2 per cent, other oilseeds 2 per cent, castor 0.2 per cent and plantation crops 3.6 per cent. The average recommended cropping pattern for the taluks of Kolar district is paddy 8 per cent, maize 5 per cent, ragi 31 per cent, bajra 4 per cent, kharif jowar 9 per cent, small millets 5 per cent, gram 0.37 per cent tur 1 per cent, other pulses 11 per cent, sugarcane 1.37 per cent, groundnut 18 per cent, sunflower 2 per cent, castor 0.37 per cent and other crops 5 per cent. The average recommended cropping pattern for Tumkur district is paddy 6 per cent, maize 2 per cent, kharif jowar 12 per cent, rabi jowar 0.4 per cent, ragi 23 per cent, small millets 8 per cent, gram 0.4 per cent, tur 4.0 per cent, sugarcane 0.4 per cent, other pulses 16 per cent, groundnut 13 per cent, plantations 5 per cent, sunflower 2 per cent, castor 1 per cent, other oilseeds 2 per cent and other crops 5 per cent.

Taluk example: Honnali ½ East (Shimoga District)

1. **Rainfall pattern:** D1E3(C1D3)C1D1E2

February to May	1 month (May)	5-10 cm
	3 months	less than 5 cm
June to September	1 month (Sept)	10-20 cm
	3 month	5-10 cm
October to January	1 month (Oct)	10-20 cm
	1 month (Nov)	5-10 cm
	2 months	less than 5 cm

2. Monthly rainfall: (mm)

January	2.8	May	85.1	September	81.0	
February	6.1	June	54.9	October	130.1	
March	4.3	July	87.9	November	45.2	
April	38.1	August	65.3	December	10.9	Total 611.

3. Soils Deep black

4. Land-use:

Geographical area 894 sq km

Per cent of geographical area under:

net area sown	56
culturable waste	1
pastures	15
forests	11
fallow	5

5. Area under principal crops

	(Thousand ha)	Per cent of gross cropped area
Paddy	16	27
Kharif Jowar	9	15
Rabi Jowar	1	2
Ragi	8	13
Small Millets	4	7
Tur	1	2
Other Pulses	6	10
Groundnut	7	13
Other Oilseeds	1	1
Cotton	2	3

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(Appendix 14.7 Statement V contd)

12. Modifications suggested: In view of better rainfall distribution double corpping under rainfed conditions is recommended, Hybrid jowar + Cotton mixture, pulse followed by chilli or cotton, groundnut or sunflower followed by rabi jowar or gram paddy followed by pulse, co-riander and sesamum followed by rabi jowar or sunflower, pulses followed by rabi jowar, setaria followed by cotton, hybrid jowar followed by bengal gram and pulses or sesamum followed by ragi. Tobacco is an important crop that can be extended in this area. Under irrigation 3 to 4 crops can be grown. Paddy should be restricted to an low-lying areas.

Important crop sequences that can be adopted are:

1.	Paddy	Wheat, Gram, Vegetables	Paddy
2.	Paddy	Groundnut	Maize, Fodder or Green gram
3.	Groundnut or Ragi or Maize or Onion or Chillies or Cowpea or Hybrid Bajra or	Onion, Chilli or Cotton or Gram or Vegetables.	Hybrid Jowar or Hybrid Bajra or Hybrid Maize or Fodder crops or Vegetables.
4.	Chillies	Cotton	Fodder or Pulses
5.	Pulses	Sea Island Cotton	Paddy

Suitable crops depending upon water availability and soil tye can be grown. Area under Sea Island Cotton to be extended.

13. Proposed cropping pattern : Paddy -20, K.Jowar-20, Rabi Jowar-10, Ragi-15, Small millets-5, Tur-5, Other pulses-15, Cotton-5, Safflower-2, Other crops-3.

14. Remarks: ½ W. Ref. Rainfall Pattern X.

APPENDIX 14.8

(Maps)

MAP	I	Rainfall Patterns (Paragraph 14.4.5)
MAP	II	Month of Maximum Rainfall together with (a) Totals of Rainfall (Rf) and Rainy days (Rd) of two consecutive months – Month of Maximum and of preceding or following whichever is higher and (b) Number of consecutive Months (n) with Month of commencement (m) of Rainfall of cm pm or higher (b_{mn}) with totals of Rainfall (Rf) and Rainy days (Rd) for these months. Entries in each taluk are shown thus: (i) $\dfrac{M}{R_f \;/\; R_d}$ (ii) $\dfrac{b_{m\,n}}{R_f \;/\; R_d}$ (Paragraph 14.4.6)
MAP	III	Rainfall Regions (Paragraph 14.5.5)
MAP	IV	Cropping Patterns (Paragraph 14.6.2)
MAP	V	Livestock Patterns (Paragraph 14.3.15)
MAP	VI	Population Density (District Map) (Paragraph 14.3.3)
MAP	VII	Net Irrigated area as percentage of Net Sown Area (1970-71) (Paragraph 14.3.8)

APPENDIX 14.9

(Paragraph 14.7.22)

Rainfall and Cropping Patterns - Karnataka

1 Introduction

1.1 The population of the country is estimated to reach 935 million mark in 2000 AD, which surely necessitates increased agricultural production. Land resources being limited, emphasis has to be placed on increasing productivity per unit area. Temperature and other climatic conditions being favourable throughout the year over most parts of the country, it is possible to grow more than one crop per year provided water is available. In some parts of the country, spread of rainy season is long enough to provide ample scope for double cropping. This potential is yet to be exploited. There is undoubtedly scope for increasing irrigation water resources in the country, but our estimates show that the area under irrigation is not expected to be more than 42 per cent of the total cropped area even in 2000 AD, although it would mean considerable improvement over the existing percentage of 22 (1970-71). Therefore, judicious utilisation of direct rainfall and irrigation water, singly and in combination, will have to be thought of for increasing production.

1.2 Farming technology has so advanced that it is possible to increase yields of crops even under rainfed conditions, but their choice would have to depend upon the amount and distribution of the prevailing rainfall. Additionally, it will be necessary that the maximum

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possible quantity of rain-water is conserved in ponds and pools situated either within the farm area or elsewhere, in soil profiles and underground storages so that the same could be readily used to save crops in times of stress. Not only in rainfed farming but even under irrigated conditions, one will have to plan for the most economic and efficient use of water to derive maximum possible benefit from rainfall reducing dependence on irrigation so that the advantage of water availability could be extended to as large an area as possible. This necessitates a close study of the existing cropping patterns vis-a-vis rainfall patterns aimed at determining the nature of changes needed in cropping patterns to make the maximum use of rain-water. The cropping patterns, as they evolve, represent the integrated effect of the requirements, local habits and economic factors through time. In the context of increasing production, it is necessary to examine them from a scientific angle and find out possible alternative patterns having higher potential. Accordingly, the Commission undertook a comprehensive study of the rainfall and cropping patterns of the country. The study covered several other relevant factors also to facilitate an integrated assessment, viz. orography, land use, human and livestock populations, operational holdings, power availability for cultural operations, soils and climate.

1.3 The information on rainfall and crops could enable one to delineate the country into suitable agroclimatic regions because crops in themselves represent an interplay of several natural factors including soils. The data thus collected during the course of the study should prove useful for various planning and reference purposes at levels ranging from taluk to all-India, besides its utility for the main purpose of arriving at the future cropping patterns. It has, therefore, been decided to present the basic results of the study together with all relevant data and maps in the form of State volumes but these State Reports will be issued separately, though along with the main Report. This Appendix dealing with Karnataka rainfall and cropping patterns is meant to serve as an illustration. It consists of six parts, the first being introduction. The second is on methodology, the third deals with general information giving a brief account of related factors such as orography, land use, soils etc. Rainfall and cropping patterns are analysed in parts four and five respectively. The concluding part gives the guidelines for future cropping patterns.

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2 Methodology And Sources of Data

2.1 The methodology adopted in the study is described in this Section. The chief features of the study are (a) use of taluk (or tehsil) as unit of area; (b) introduction of the concept of numerical form to express patterns of distribution of rainfall, crops and livestock and assigning them suitable codes and (c) inclusion of information on orography, temperature, evapotranspiration, rainfall, soils, irrigation, land use, size of operational holdings, human and livestock populations, power availability for field operations and yield performance of crops, all of which influence in different ways and degrees the cropping patterns of a place. The information so coded is then presented on maps of 1:1 million scale.

Rainfall Patterns

2.2 A major feature of Indian rainfall is that more than 70 per cent of it occurs during the south west monsoon months of June to September throughout the country, except the south east Peninsula and Kashmir. The monsoon as well as annual rainfall show large fluctuations from year to year, but there is no evidence of any significant trend or periodicity in them when examined over a long period. Because of the lack of such trend, it is possible to classify regions in the country possessing characteristic rainfall patterns. When the examination of rainfall is considered in relation to crop production, the annual or seasonal totals do not have much significance compared with smaller intervals. Then, a pertinent question to answer is whether rainfall should be considered on a weekly, fortnightly or monthly basis. The coefficient of variation of rainfall is as high as 40-50 per cent even in the rainiest month of July, over most of the central, northern and eastern India. The variability of weekly or fortnightly rainfall is many times greater. This is a major difficulty in using weekly and fortnightly averages as dependable indicators of rainfall distribution. Therefore, while studies for individual or specific problems on the basis of weekly or fortnightly rainfall data have their own utility in spite of their high variability, for a macro-study like the present one involving the whole country, monthly data are most convenient.

2.3 In order to facilitate examination of the distribution of rainfall during periods of crop growth, limits of rainfall which have closer relation to broad requirements of crops, have been drawn up. The time span of crops is usually of the order of 90 days or longer. Keeping this in view, the following limits have been used in the study:-

i) Rainfall of greater than 30 cm per month (pm) for at least three consecutive months would be suitable for a crop like paddy whose water need is very high.

ii) 20-30 cm pm for not less than three consecutive months, would be suitable for crops whose water need is high but less than paddy, for example, maize and blackgram.

iii) 10-20 cm pm for at least three consecutive months is considered suitable for crops requiring much less water, e.g., bajra and small millets.

iv) 5-10 cm pm is just sufficient for crops which have low water requirements, e.g. moth (P.aconitifolius) and ephemeral grasses.

v) Rainfall less than 5 cm pm is not of much significance for agriculture.

2.4 For denoting the year's rainfall distribution, the limits of rainfall have been designated by symbols as follows:-

symbols	rainfall cm pm
A	greater than 30
B	20-30
C	10-20
D	5-10
E	less than 5

In distributions involving higher amounts of rainfall of A or B type, lower association of D type are more common than E. Therefore, in order to reduce the number of symbols in distributions beginning with A or B and at the same time give an idea of the possibility of occurrence of rainfall of even less than 5 cm pm, symbol E has been used to denote amounts of less than 10 cm pm, skipping the use of symbol D. Such instances are not many. A numerical subscript is affixed to these alphabets in order to indicate the number of months in which a particular amount of rainfall is received. As June-September period is important in most parts of the country, this is shown in the coded form by a bracket, the four months of Feb-May being on its left and the remaining four months October-January on the right. An example of a yearly distribution is D1 E3 (A2 B1 C1) C1 D3, in which for each of the three periods the symbols are in order of decreasing rainfall but not necessarily in order in which they occur

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in the calendar. Its numerical interpretation is as follows:-

i) D1 E3 represents the period February to May, in which one month's rainfall (usually May) belongs to 5-10 cm type and the remainder three months get less than 5 cm pm.

ii) A2 B1 C1 represents the period June to September, in which two months (usually July and August) get more than 30 cm pm, one month (September) belongs to 20-30 cm type and the remaining month i.e. June to 10-20 cm type.

iii) C1 D3 represents the period October to January, in which October belongs to 10-20 cm type and the rest to 5-10 cm pm type.

2.5 If an identical distribution occurs over two or more adjacent taluks, it is designated as pattern and the area covered by a pattern is distinguished as a zone and indicated by Roman numerals. Rainfall patterns have been identified, following the above procedures by utilising the 50 year normals of about 2,700 rain gauge stations as contained in the India Meteorological Department's Memoirs XXXI (III) 1962 and depicted on maps of 1:1 million scale. The terminology which has been adopted usually while discussing rainfall is indicated below.

terminology	use
(i) rainfall pattern	when a season's or all the 12 months' distribution is meant
ii) type	When rainfall of any of the 5 rainfall limits is discussed, e.g., A type, B type etc.
iii) category	When a range between a few types is described, e.g., A2-B2 category, B1-C4/C3 category etc.

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Cropping Patterns

2.6 The study of cropping patterns has been based on the gross cropped area at the taluk level for 1969-70, obtained from the States. An attempt has been made to cover as many crops as possible in the analysis. Because the number of crops is large and vary from taluk to taluk, only those crops which individually occupy 10 per cent or more of cropped area have been considered for inclusion in cropping patterns. As such crops having lesser area spread have been often excluded even though they might be of local importance e.g., vegetables, potato, tobacco, sugarcane, grapes. The minimum limit of the area to be accounted for by a cropping pattern has been fixed at 70 per cent, after many trial computations. By adopting this criterion the number of crops to be considered in a pattern does not usually exceed four or five. Thus, a combination of crops, each occupying not less than 10 per cent of the gross cropped area of taluk and making a total of 70 per cent or more of the gross cropped area, is considered sufficient to constitute a cropping pattern provided that it extends over at least two adjacent taluks.

2.7 The crops codes together with percentage area coverage as used in the study is given below:

Crop	Code	Crop	Code
paddy	Pd	groundnut	Gn
pulses other than pigeonpea and gram	Pu	Oilseeds other than groundnut	O
potato	Pt	oats	Oa
wheat	W	cotton	C
maize	M	other fibres	Fb
small millets other than ragi	Mt	fodder	F
jowar kharif	Jk	fruits	Fr
jowar rabi	Jr	plantations	L
jute	Ju	sugarcane	S
bajra	B	vegetables	V
barley	Ba	chillies	Ch
ragi	R	pigeonpea (tur)	T
gram	G	tapioca	Ta

area coverage* (percent)	
70 or more	1
50-70	2
30-50	3
10-30	4
less than 10	5

*overlapping points are suitably adjusted

The code number indicating the percentage area coverage by a particular crop is affixed as a subscript to the crop symbol concerned. For example, C3 Jr4 Mt4 would indicate that cotton area is 30-50 per cent and jowar rabi and millets each occupy 10-30 per cent of the gross cropped area. Where each of the crops occupies say, 10-30 per cent of the area, e.g., in the cropping pattern C4 Jk4 Jr4 Mt4/Gn4 the crop covering the largest area would be placed first, but the subsequent crops do not follow in any particular sequence. The cropping patterns so derived have been indicated on maps of 1:1 million size.

Livestock Patterns

2.8 Since talukwise figures based on Livestock Census 1972 have not become available, 1966 Census figures as published by the States have been used. The categories

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of animals included are shown below together with the symbols used in the present study.

Category	Symbol
cattle:	
males over 3 years	Cm
females over 3 years	Cy
young stock 3 years and under	Cy
buffaloes:	
males over 3 years	Bm
females over 3 years	Bf
young stock 3 years and under	By
sheep	S
goats	G
horses, mules and ponies	H
donkeys	D
camels	Ca
pigs	P

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Following the same procedure and percentage intervals as in cropping patterns, livestock patterns have been identified and expressed in coded form.

2.9 Soil data corresponding to the scale used for the rainfall, crops and livestock patterns are not available for all the areas of the country. Out of about 305 Mha of the country's surveyable area, only about 90 Mha have been surveyed by one method or the other, but some of these areas need resurveying. In some States like Bihar and West Bengal, which have been covered almost wholly by reconnaisance survey, the work in soil correlation has not made much progress. Because of this we have recommended in our Interim Report on Soil Survey and Soil Map of India (August, 1972) that expeditious measures should be undertaken to prepare a soil map in 1:1 million scale. We envisaged that a useful soil map of India could be prepared within about 10 years' time, if necessary steps to organise soil survey parties in accordance with specific requirements are commenced urgently. In view of the present status of soil survey work it has been possible only to give a broad description of soil types based on the information available in the map prepared by the All-India Soil and Land Use Survey, Indian Agricultural Research Institute (1972 Edition).

Operational Holdings

2.10 In regard to operational holdings, information has become available only very recently as part of the Agricultural Census 1970[1]. The number and area under different class intervals of holdings ranging from 0.5 to 50 ha or above as percentages of the total number of holdings and the total area operated, for all the districts have been taken from the census report for the present study.

Power Availability for Crop Production

2.11 The components of power are human, animal, mechanical and electrical. Human power reckoned here comes from cultivators, agricultural labour and those engaged in livestock, forestry, fishery, plantations etc., as reported in the Population Census, 1971. In the case of animal power, the data are based on the Livestock Census 1972. Information on Agricultural machinery has also been obtained from the same source. The contribution of each of the power components has been taken to be as follows.

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[1] Agricultural Census Commissioner, Government of Karnataka, 1974, Census of Agricultural Holdings in Karnataka - 1970-71.

	Component	Horse power (HP) per unit
i)	human (for each person in the age group 15-59 years - mean value for males and females combined)	0.06
ii)	animals	
	bullocks and he - buffaloes	0.40
	camels	1.00
iii)	mechanical/electrical	
	tractors	25.00
	power tiller	7.00
	power sprayer/duster	2.00
	diesel engine	7.00
	electric motor	6.00
	electrically operated sugarcane crusher	6.00

Note- For details please see Chapter 50 on Farm Power (Statement I, Appendix 50.1)

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As tractors are also employed for hauling operations etc, only 50 per cent of the tractor power is assumed to be utilised in farm operations. In the case of human and animal power, 20 per cent is allowed for extra farm activities; hence only 80 per cent of total human and animal power, is taken as power available from these sources for farm operations.

Other Factors

2.12 The sources of data pertaining to other factors included in the study are given below:

factor	source
taluk area	States' Census Report 1971 or from the data furnished by the States in their land-use returns
orography	maps published by the Survey of India and National Atlas Organisation
temperature	Climatological Tables of Observatories in India, India Meteorological Department, 1931-60 normals
Evapotranspiration	Scientific Report No.136 of the India Meteorological Department, 1971
Human population	Census of India, 1971
irrigation and land use statistics	Basic data pertaining to land utilisation statistics was obtained from the States and mostly relating to 1969-70
relative yield index (RYI-The district or State yield average expressed as per cent of all-India average)	Directorate of Economics and Statistics, Ministry of Agriculture and Irrigation. Data on crop yields are available only for districts and, therefore, district averages (1968-69 to 1970-71) have been utilized.

Presentation of Information

2.13 The tables, which are of direct use to the text, are included in Annexure 1. This consists of the following 10 statements:-

Statement I	Districtwise Frequency Distribution of Areas of Talukas in Different Class Intervals of Area
Statement II	Mean Daily Temperature (°C) for Observatories in Karnataka

Statement III	Mean Daily Maximum Temperature (°C) for Observatories in Karnataka
Statement IV	Mean Daily Minimum Temperature (°C) for Observatories in Karnataka
Statement V	Normal Monthly and Annual Potential Evapotranspiration (PE) for selected Observatories in Karnataka.
Statement VI	Irrigation Statistics
Statement VII	Land Use Statistics - Percentage of Reporting Area (1969-70)
Statement VIII	Frequency of Taluks in Different Ranges of Population Density
Statement IX	Percentage of Operational Holdings and Area Operated
Statement X	Availability of Power per Hectare of Cultivated Area

2.14 All small sized maps have been presented in Annexure 2. These maps are:

Maps I - XIV	Rainfall and Coefficient of Variation-May to October and Annual [illegible]
XV	Net Sown Area as per cent of Reporting Area
XVI	Irrigated Area as per cent of Gross Cropped Area as cropped Area
XVII	Density of Population
XVIII	Total Power Available for Cultural Operations (per ha of cultivated area)

2.15 The basic data, on which the present study is based, are elaborate in nature. To facilitate reference to these data the following Annexures have also been included:-

Annexure 3	Zonewise (according to rainfall zones) Land Use and Population Statistics.
Annexure 4	Zonewise Livestock Statistics
Annexure 5	Zonewise Information on Rainfall, Rainy Days and Cropping Patterns of the concerned Taluks.

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Annexure 6	Zonewise Information on Crops of the concerned Taluks
Annexure 7	Statement I - Districtwise Rainfall, Cropping and Livestock Patterns together Statement II - Rainfall, Cropping and Livestock Patterns of Taluks in each of the Districts Statement III - Zonewise Arrangement of Cropping and Livestock Patterns together.

2.16 The maps, which are of 1:1 million size, have been given at the end in Annexure 8. These will prove of constant use in the understanding of rainfall and cropping patterns. Their titles are:

Map I	Rainfall Patterns
Map II	Month of Maximum Rainfall Amount and Rainy Days of Two Consecutive Months including the Month of Maximum.
Map III	Cropping Patterns
Map IV	Livestock Patterns
Map V	Soils.

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3 General Information

3.1 The geographical area of Karnataka is about 190,000 sq Km. The State is divided into 19 districts, varying in area from 4,000 sq Km (Coorg) to over 17,000 sq Km (Bijapur) as shown below:

Number of districts with area (thousand sq Km) of							
4-6	6-8	8-10	10-12	12-14	14-16	16-18	Total
3	3	3	5	3	1	1	19

The State has 175 taluks each with an average area of 1,100 sq Km. The frequency distribution of areas of taluks in each district in different intervals of area is given in Annexure 1 - Statement I.

Orography

3.2 The principal orographic feature of the State is the Western Ghats running north to south along or close to western boundary of Belgaum, Dharwar through Chikmagalur and Hassan to Mysore. The Ghats are at elevations ranging up to 1,500 m (metres above sea level) and at places are as high as 1,700 to 1,900 m. The Ghats divide the State into the coastal and Ghat regions to their west and a wide plateau area on their eastern lee side. The coastal belt is less than 200 m in height and 50 Km in width. Almost the entire district of Coorg is at elevation of 900 to 1800 m except for the small area of Virajpat, which is at an elevation of 150 m. On the lee side, the heights vary from 600 m in the south to more than 1,500 m over the Ghats. The plateau elevation generally ranges between 400 and 600 m in the northern districts, particularly Bijapur, Gulbarga and Raichur.

Temperatures

3.3 The temperature conditions of the State (Annexure 1 - Statements II to IV) are summarised below:

	coast	interior
i)	Mean daily temperature:	
	The annual normal is 27°C. Range of monthly variation is small (25 - 29°C)	The annual normal varies between 23 and 27°C (excluding elevated stations). Range of monthly temperatures is large.
	July-September temperatures are uniform (25 - 26°C.)	July-September temperatures are uniform within a degree.
ii)	Maximum temperature:	
	The highest is in April - May (32 - 34°)	March to May are the hottest months in the northern districts of Raichur, Gulbarga and Bijapur (38 - 40°C) and 32 - 34°C in the plateau areas of the south.
iii)	Minimum temperature:	
	December to February temperatures are the lowest (19 - 22°C)	December and January have the lowest normals (14 - 17°C).

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Potential Evapotranspiration

3.4 Penman's formula, based on energy balance and aerodynamic considerations has been utilised for the calculation of potential evapotranspiration (PE). Monthly and annual values of PE for 17 stations in the State are[1] given in Annexure I - Statement V. The annual PE variations range from between 130 and 150 cm in the coastal and southern plateau areas and between 160 & 200 cm in the northern areas. The annual PE for Raichur is 195 cm. PE is 9 to 10 cm per month in the coastal areas and much higher at 14 to 16 cm pm in some interior areas during the months of June to September. PE is considerably less than rainfall in the coastal areas but is of the same order or higher in the interior, even in the rainy months.

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[1] Rao, K.N., George, C.J and Ram Sastry, K.S. Potential Evapotranspiration over India. Prepublished Scientific Report No.136, India Meteorological Department.

Soils

3.5 A narrow coastal strip is classified as coastal alluvium. Adjacent to it and extending from south to north with a width of about a third to half degree the soil is lateritic. This belt is followed by another of red loamy soils. In the rest of the State, two main groups of soils prevail:

i) Red sandy soils - These occur to the south of Latitude 15°N. There are however patches of (a) laterites in North Kolar and surrounded by red loam area in northern Bangalore, portions of Kolar and eastern third of Tumkur district and (b) medium or deep black and a small area of mixed red and black soils in Chitradurga district.

ii) Medium black soils - These contain patches of (a) mixed black and red in Raichur, Bellary, Belgaum, Bijapur and Dharwar districts, (b) sizable area of deep black running north of Lat. 20°N. (a third of a degree in extent) and (c) laterite in South Bidar and adjoining Gulbarga districts. Map V of Annexure . 8 shows the soils of Karnataka State.

Irrigation

3.6 The gross irrigated area in the State in 1969-70 was about 1.3 M ha which represented 12 per cent of the gross cropped area for that year. Fifteen districts out of 19 have less than 20 per cent irrigated area. Districtwise position of irrigated area (Annexure 1 - Statement VI, Annexure 2 - Map XVI) can be summarised in the following manner:-

Percentage of gross cropped area irrigated	districts
5 or less	Gulbarga, Bidar, Bijapur, Dharwar
5.1 - 10.0	Coorg, Bellary.
10.1 - 15.0	Belgaum, Raichur, Chikmagalur, Mysore
15.1 - 20.0	Tumkur, Bangalore, Hassan, N.Kanara Chitradurga
26.1 - 34.0	Kolar, S.Kanara, Mandya
51	Shimoga

Examination of taluk data shows that about 70 per cent of the taluks have less than 20 per cent irrigation. Better irrigated taluks lie in the southern districts. The taluks in three adjoining districts i.e., Bijapur, Gulbarga and Bidar, have the lowest irrigation with only two taluks having 10 per cent irrigation. Only 4 of the 17 taluks of Dharwar District have more than 10 per cent irrigation, 3 talukas have 10 - 20 per cent irrigation and one taluk lies in the 40 - 50 per cent interval. Of the seven taluks with more than half the area irrigated five are in Shimoga (50 to 100 per cent) and one each in Mandya and Chitradurga. All the taluks rely more on tanks and wells, which account for 60 per cent of the irrigated area. Canals account for 33 per cent of the irrigated area, but in the majority of the taluks (116) the area catered by them is less than 10 per cent of the irrigated area, whereas the area served by tanks and wells in 120-130 taluks is of higher order.

Land Use

3.7 Districtwise land-use is given in Annexure 1 - Statement VII and Annexure 2 - Map XV. It will be seen that 15 per cent of the geographical area of the State is under forests. Areas not available for cultivation, pastures and fallow lands each constitute 8 to 9 per cent of the total area with cultivable waste constituting another 3 per cent. Forests dominate the coastal and adjoining areas, Coorg and the southern parts of Mysore. In Kanara District eightyone per cent of the North Kanara taluk and 91-93 per cent of the Supa and Yellapur taluks is under forests. Fifty per cent area of Khanapur adjoining Supa is also forest area. In Coorg, eastern taluks of South Kanara and Chikmagalur and the southern taluks of Bangalore and Mysore are 30 - 40 per cent of the area is forest; in Kollegal taluk area under forests is higher than 70 per cent. The spread of areas under permanent pastures also **varies**. In Shimoga and Kolar, permanent pastures 25 - 26 per cent of total area, in Chikmagalur 22 per cent and in the other southern districts 12-15 per cent. In other parts of the State the extent of such areas is negligible.

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3.8 The State average for cultivable waste is indeed small, there being only 9 taluks where more than 10 per cent of the geographical area comes under this category. In Nagamangla taluk the incidence of cultivable waste lands is highest at 30 per cent of the total area. Fallow lands are of the order of 15-20 per cent in Hassan, Tumkur and Bidar. In Raichur District an average of 12 per cent of the total area lies fallow and in the remaining districts extent of fallow lands is less than 8 per cent. The State average of net sown area is 54 per cent. In the coastal belt (Kollegal and Heggaddevankote taluks) net sown area is the lowest at 20 per cent or less of the total area. In Coorg this proportion is 29 per cent and in Kolar area it is 38 per cent. It is 40 - 60 per cent over most of the area up to about Lat. 15-16°N. and mostly 70-95 per cent elsewhere. Supa and Yellapur are the lowest with 3-5 per cent and there are two significant areas of about 90 per cent surrounding (i) Navalgund and Nargund and (ii) another in Bagewadi-Sindgi taluks. The frequency distribution of taluks falling in different class intervals of net sown area is shown below:

Number of taluks with net area sown as per cent of geographical area of									
less than 10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
3	20	12	28	21	22	20	25	18	6

Net area sown accounts for only 10 per cent of the geographical area in North Kanara. The corresponding percentages for the southern districts are mostly between 30-50 per cent.

Bellary and Bidar are 61 per cent, Belgaum, Raichur and Gulbarga 70-75 per cent and Bijapur and Dharwar over 80 per cent.

3.9 The area sown more than once is only 6 per cent of the net sown area of the State. The cropping intensity is thus only 106 per cent. It is highest in South Kanara district (143 per cent). Mysore and Bidar are the next highest with 120 per cent. The cropping intensity among taluks is shown below:

Number of taluks with cropping intensity of					
less than 110%	110-120%	120-130%	130-140%	140-150%	150-160%
131	23	8	7	5	1
* (74.9)	(13.1)	(4.6)	(4.0)	(2.8)	(0.6)

There are only six taluks with intensity in the range of 140 to 160 per cent; four of these are in South Kanara district and one each in Shimoga and Mysore districts. The maximum crop intensity of 160 per cent is in Udipi taluk.

Population

3.10 The total population of the State is 29.3 million and the average density is 153 per sq Km. The percentage rural population of the total in the State is 77 per cent. Bangalore district has the lowest rural population of 45 per cent only. It will be seen from Annexure 1 - Statement VIII, Annexure 2 - Map XVII that among the districts, Bangalore has the highest density of 419 per sq km and the next highest are Mandya and South Kanara with a density of about 235 per sq km. The density of other districts varies between 83 (North Kanara) and 185 (Kolar). Analysis of taluk distribution shows higher density of population from Kolar and Bangarpet taluks to Mysore in south and from Udipi to Bantwal over the coast. All but 2 of the 9 taluks with density of more than 300 per sq km are in these two areas. Belgaum and Hubli taluks are the remaining two. A nearly north to south belt running from Khanapur through Supa and Yellapur to Manjarabad has density of less than 100 per sq km. Supa and Yellapur have the lowest with 19 and 34 per sq km respectively. In general, the density of northern taluks is not high. A number of taluks in Raichur district have density of less than 100 per sq km.

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* Figures in parantheses represent percentage to total number of taluks.

Operational Holdings

3.11 The total number of operational holdings in the State in 1970-71 was 3,551 thousands covering a total area of 11.367 Mha of net sown area, current fallows, cultivable waste and area not available for cultivation. The following table gives the per cent frequency of holdings in different class intervals of area and also the per cent of total area covered by each of the class intervals:

size of holdings (ha)	per cent of total	
	number of holdings	area operated
2 or less	54	16
2 - 5	28	27
5 - 20	17	46
more than 20	1	11

A close examination of the data in Annexure 1 - Statement IX shows that larger size of holdings are concentrated in the northern half of the leeward side of the Ghats. Due to factors like irrigation and pressure of population the size of holdings is smaller in the southern half.

Livestock

3.12 Fourteen livestock patterns have been identified for the State. These are classified below into six groups according to predominance of different species:

I Sheep predominant

1 S3 G4 Cf4/Cm4/Bf4

2 S3 Cm4 Cf4 G4/Cy4/Bf4

3 S4 Cm4 Cf4 G4/Bf4/Cy4

4 S4 G4 Cm4 Cf4/Bf4

II Goats predominant

1 G4 S4 Cm4 Cf4/Cy4/Cy4 Bf4

III Male cattle (Cm) predominant

1 Cm3 Cf4 Cy4

2 Cm4 Cf4 Cy4/P4

3 Cm4 Cf4 Cy4 G4/S4/Bf4

IV Female cattle predominant

1 Cf3 S4 Cy4/G4/Cm4

2 Cf3 Cy4 Cm4/Bm4

3 Cf4 Cy4 Cm4/Cm4 Bm4

V Female buffaloes predominant

1 Bf4 Cm4 By4 Cf4

VI Young stock of cattle predominant

1 Cy3 Cf3

2 Cy3 Cf4 Cm4 S4

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3.13 The livestock pattern of the State as a whole is S4 Cm4 Cf4 G4/Cy4. The largest in numbers is sheep, being nearly a quarter of total livestock population of 20.5 million.Sheep predominante in about two-third of the taluks in the State, covering mostly the eastern and central parts and extending from Gundlupet in the extreme south to Yadgir in the northeast and Chikodi of Belgaum district in the northwest excluding some of the southern taluks of Bijapur district. Goats have higher percentage than the other categories of livestock in a large part of Bijapur district and neighbourhood. In the remainder of the State, male or female cattle predominate. Female buffaloes and male catt have nearly the same percentage in Belgaum and Bailhongal taluks and these are grouped in a pattern beginning with Bf. In a few of the taluks of South Kanara, percentage of male buffaloes is significant enough to enter into a pattern as an alternate category. Pigs are significant in Mercara and Virajpet. The patterns for the districts could be expressed as follows:

patterns	districts
S3 G4 Cm4 Cf4	- Tumkur, Kolar, Mandya, Chitradurga
S4 G4 Cm4 Cf4/Cy4	- Bangalore, Bellary, Raichur
S4 G4 Cm4 Bf4	- Belgaum
G4 S4 Cm4 Cf4	- Bijapur
Cm4 Cf4 Cy4 S4/G4/Bf4	- Chikmagalur, Shimoga, Gulbarga, Bidar, Dharwar
Cm4 Cf4 Cy4	- N.Kanara, Coorg
Cf4 Cm4 S4 G4/Cy4	- Mysore, Hassan
Cf4 Cm4 Cy4 Bm4	- S.Kanara

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Power Availability for Crop Production
(Annexure 1 - Statement X, Annexure 2 - Map XVIII)

3.14 The agricultural working population is only one-fifth of the total population of the State, which is the same as in the country as a whole. The availability of power per hectare of cultivated area from different sources totals to 0.28 HP, the percent contribution of individual components being as follows:

component	percent of total power
human	9.5
animal	41.5
mechanical/electrical	
tillers	0.3
tractors	2.6
sprayers/dusters	2.5
diesel engines	10.1
electric motors	31.8
crushers	1.7

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It has been assumed that only 80 per cent of the human and animal power and half of the tractor power is utilised for cultural operations.

3.15 It may be noted that the above estimates of power availability are for all the operations - tillage, interculture, irrigation, plant protection and post-harvest. It would be necessary to estimate the power availability for each cultural operation like tillage and interculture. This information is given in col.2 of Table 1. The power available for cultural operations in Bangalore, Belgaum, Bidar, Bijapur, Kolar, South Kanara and Tumkur is less than half of the total availability (within 35-45 per cent). This is because the total power availability is boosted due to diesel engines and electric motors, whose share in these districts is considerable - (Bangalore 61, Belgaum 50, Bidar 56, Bijapur 51, Kolar 63, S.Kanara 53 and Tumkur 53 per cent). It is important to note that animal power dominates in cultural operations ranging between 70 and 80 per cent except in the case of Bangalore (59 per cent). Human power comes next accounting for 15-30 per cent of the total power availability. The contribution of mechanical power is very small, generally around 5 per cent of the total except in case of Coorg, Raichur and Shimoga (8-10 per cent) and Bangalore (16 per cent). A reference to Annexure 2-Map XVIII would show that the southern half of the State has higher power availability compared to the northern half. The coastal belt has higher power availability of 0.3 - 0.5 HP per hectare, presumably on account of the fact that the extent of cultivable area is comparatively lower in this area.

Table 1

Power available for Cultural Operations

district	power available for cultural operations				
	actual (HP/ha)	% of total power for all operations	per cent of total contributed by		
			human	animal	mechanical
Bangalore	0.19	35	25	59	16
Belgaum	0.14	44	20	75	5
Bellary	0.12	58	17	77	6
Bidar	0.09	38	20	78	2
Bijapur	0.07	45	21	73	6
Chikmagalur	0.27	78	13	81	6
Chitradurga	0.22	56	17	77	6
Coorg	0.29	80	13	79	8
Dharwar	0.11	68	18	77	5
Gulbarga	0.08	67	16	82	2
Hassan	0.22	80	15	81	4
Kolar	0.31	32	21	75	4
Mandya	0.23	64	19	80	1
Mysore	0.22	67	18	80	2
N. Kanara	0.45	73	15	84	1
Raichur	0.11	73	15	75	10
Shimoga	0.32	77	12	79	9
S.Kanara	0.38	43	17	81	2
Tumkur	0.19	44	20	78	2
State	0.15	54	18	77	5

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4 Rainfall Patterns

4.1 The rainfall zones together with their patterns, gross cropped area, number of taluks and districts are mentioned in Table 2 and are also depicted in the map (Annexure 8 - Map I) A narrow belt comprising Zones XI. XII, XVIII and part XXV runs in a north south direction along the Ghats separating the coastal side to west and leeside to east in which the cropped area constitutes 4.9 per cent of the total gross cropped area of the State. The coastal belt to west accounts for 5.5 and rest of the State to east of Ghats 89.6 per cent of the gross cropped area. In terms of the category of rainfall during the south west monsoon season, the distribution of gross cropped areas is indicated below:

Rainfall category (SW monsoon)	Zones	Gross cropped area actual (Mha)	Gross cropped area per cent of total
A4 to A_1	XII to XVIII XXI, XXII, XXV, XXVI	0.84	7.8
B_1	IV, IX	0.69	6.4
C4 to C_1 (mostly in combinations of C & D types)	1 to III VI to IX, X, XIX, XX, XXIV	9.00	83.4
D2 E2	V, XXIII	0.26	2.4
total		10.79	100.0

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Table 2
Particulars Regarding Rainfall Zones

Zone	Rainfall pattern	Gross cropped area (M ha)	Number of taluks		districts
			full	part	
I	E4 (C1 D3) D1 E3	1.53	11	(1)-2/3	Bijapur, Raichur.
II	E4 (C3 D1) D1 E3	0.78	6	(1)-1/3	Gulbarga, Raichur.
III	E4 (C4) D1 E3	0.65	7		Gulbarga
IV	E4 (B1 C3) D1 E3	0.41	5		Bidar
V	D1 E3 (D2 E2) C1 D1 E2	0.13	2		Chitradurga
VI	D1 E3 (C1 D3) D1 E3	2.29	24	(1)-1/2	Belgaum, Raichur, Dharwar, Bellary, Chitradurga.
VII	D1 E3 (C1 D3) C1 D1 E2	1.14	21	(5)-1/2	Dharwar, Shimoga, Chitradurga, Tumkur, Kolar, Bangalore, Chikmagalur.
VIII	D1 E3 (C2 D2) C1 E3	0.62	9		Belgaum, Dharwar.
IX	D1 E3 (C2 D2) C1 D1 E2	0.49	12	(3)-1/2	Tumkur, Kolar, Bangalore.
X	D1 E3 (C3 D1) C1 E3	0.19	2	(3)-1/2	Dharwar, Shimoga
XI	D1 E3 (B1 C2 E1) C1 E3	0.28	7	(2)-1/2	N.Kanara, Dharwar, Shimoga, Hassan.
XII	D1 E3 (A1 B1 C2) C1 E3	0.11	2	(1)-1/2, (1)-2/3	Belgaum, N.Kanara, Shimoga
XIII	D1 E3 (A3 C1) C1 E3	0.07	3		N.Kanara, Belgaum
XIV	D1 E3 (A3 C1) C1 D1 E2	0.05	1	(2)-1/2, (2)-1/3	Shimoga, N.Kanara
XV	D1 E3 (A3 B1) C1 E3 E2	0.01	1		N.Kanara
XVI	D1 E3 (A3 B1) C1 D1 E2	0.10	5	(2)-1/2, (1)-2/3	Shimoga, N.Kanara, Chikmagalur.
XVII	D1 E3 (A4) C1 D1 E2	0.03	3		N.Kanara
XVIII	D2 E2 (A2 B1 C1) C1 D1 E2	0.01	1		Chikmagalur
XIX	C1 E3 (C1 D1 E2) C1D1E2	0.24	6		Mandya
XX	C1 E3 (C2 D2) C1D1E2	0.19	5	(1)-1/2	Bangalore
XXI	C1 E3 (A4) C1 D1 E2	0.16	4		S.Kanara
XXII	C1 E3 (A4) B1 C1 E2	0.11	4		S.Kanara
XXIII	C1D1E2 (D2E2) C1D1E2	0.13	2		Mysore
XXIV	C1D1E2 (C1D3) C1D1E2	0.68	14	(1)-1/2	Tumkur, Hassan, Mandya, Mysore
XXV	C1D1E2 (A3C1) C1D1E2	0.13	2	(2)-1/2	Chikmagalur, Hassan, Coorg.
XXVI	C1D1E2 (A4) C1D1E2	0.06	1	(1)-1/2	Coorg
	total	10.79	160+15 = 175		

4.2 Parts of the State receive rainfall during the pre and post-monsoon periods also. The contribution of the rainfall of these periods in different zones is examined in Table 3 against different categories of rainfall of the southwest monsoon period. The pre and post-monsoon period rainfall is mostly of C1 or C1 D1 type - C1 being either in May or October. Zones having rainfall both in pre as well as post-monsoon periods in these categories cover only about 15 per cent of the total gross cropped area of the State and are confined to about 37 taluks of the southern districts of Chikmagalur, South Kanara, Hassan, Coorg, Mysore, Mandya, Bangalore and Tumkur. Zones having rainfall of C1 or C1D1 type in the post-monsoon period only cover 30 per cent of the area spread over 30 taluks in the districts of Belgaum, Dharwar, North Kanara, Shimoga, Chitradurga, Chikmagalur, Hassan, Tumkur, Kolar and Bangalore. The districts which are least benefited by the pre- and post-monsoon showers are Bellary, Raichur, Bijapur, Gulbarga and Bidar accounting for a total of 43 taluks, although these districts do receive some significant rainfall in October.

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Table 3

Position of Pre-Monsoon and Post-Monsoon Rainfall

(area = Mha)

SW monsoon categories	Zones having-rainfall both in pre- as well as post-monsoon period						Zones having rainfall only in postmonsoon period			
	B1 C1		C1 D1		C1		C1 D1		C1	
	zone	area	zone	area	zone	area	zone	area	zone	area
A3/A4	XXII	0.11	XXI	0.16			XIV	0.05	XIII	0.07
			XXV	0.13			XVI	0.10	XV	0.01
			XXVI	0.06			XVII	0.03		
A1/A2							XVIII	0.01	XII	0.11
B1									XI	0.28
C3/C4									X	0.19
C2			XX	0.19			IX	0.49	VIII	0.62
C1			XIX	0.24			VII	1.14		
			XXIV	0.68						
D2			XXIII	0.13			V	0.13		
Area under all A categories	actual = 0.46 % of State gross cropped area = 4.3							0.19 1.7		0.19 1.7
Area under B1/C3/C4	actual = - %							-		0.47 4.4
area under C2/C1/D2	actual = 1.24 % 11.5							1.76 16.3		0.62 5.7
Involved districts with number of taluks in parenthesis	A		Chikmagalur, S.Kanara, Hassan, Coorg - (12½)				Belgaum, N.Kanara, Shimoga, Chikmagalur(20½)			
	B1/C3/C4						N.Kanara, Dharwar, Shimoga, Hassan(11½)			
	C2/C1/D2		Mandya, Mysore, Hassan, Tumkur, Bangalore - (28)				Belgaum, Dharwar, Shimoga, Chitradurga, Tumkur, Kolar, Chikmagalur, Bangalore - (48)			

5. Existing Cropping Patterns

5.1 The gross cropped area in the State in 1969-70 was 10.79 Mha. Fifty five per cent of the cropped area was under cereals and 13 per cent under pulses. Even though horsegram (Dolichos biflorus) is locally important, it is not recorded separately but is included under other pulses in the all - India statistics. Amongst cereals, ragi has an important place in the State. Cereals and pulses together account for nearly 70 per cent of the gross cropped area. Oilseeds cover 12 per cent in area, cotton 10 per cent and plantations 3 per cent. Oilseeds, cotton and plantations together contribute a quarter of the gross cropped area. Fodder crops are also significant in the State's cropping pattern. However, there does not seem to be any uniformity in the reporting of area under them. Nature grown grasses on the hill slopes and plateau areas are fed as green and also cut and stacked as hay after rainy season. In the erstwhile Bombay State such grasses were reported in the crop returns. As a legacy of this practice, the areas contiguous with Maharashtra even now continue to report these. In some other parts, cultivated fodders are also sometimes reported. Due to the lack of systematic reporting of fodders with a clear distinction between the cultivated and nature grown fodders there is a serious lacuna in the available data. Utilising the available crop data, 43 cropping patterns have been distinguished for the State which are summarised in Table 4:

Table 4
Summary of Cropping Patterns

Predominant crop	Patterns beginning with	Number of patterns	Number of taluks	Total patterns	Total taluks	Gross cropped area of taluks (M ha)
paddy	pd1	1	18	8	45	1.45
	pd2	1	12			
	pd3	1	2			
	pd4	5	13			
jowar (kharif)	Jk3	1	2	5	13	0.96
	Jk4	4	11			
jowar (rabi)	Jr3	4	14	7	18	2.36
	Jr4	3	4			
ragi	R2	1	16	7	46	1.89
	R3	4	24			
	R4	2	6			
small millets	Mt4	1	2	1	2	0.13
other pulses	Pu4	5	9	5	9	0.72
groundnut	Gn3	2	6	4	11	0.84
	Gn4	2	5			
cotton	C3	3	6	7	21	2.07
	C4	4	15			
plantations	L2	1	4	2	8	0.27
	L3	1	4			
wheat	W3	1	1	1	1	0.10
miscellaneous	-	1	1	1	1	negligible
total				48	175	10.79

Cropping Patterns of Zones with 'A' type of Rainfall

5.2 Cropping patterns involving 'A' type of rainfall in the SW monsoon season are mentioned in Table 5. Paddy dominates the arable crops and maize comes next to paddy. Because of abundance of rainfall, natural grasses also grow in these parts and, therefore, fodder appears in a number of cropping patterns. Cattle rearing is common in these parts owing to availability of grass fodder. However, as the grasses are inferior, lacking specially in calcium and phosphorus due to the poor nature of soils, the animals are short statured and weak (malnad breed). The next significant feature of many of these zones is the presence of plantation crops, e.g., pepper, cardamom, arecanut, cashewnut, coconut, tea, coffee and rubber. These are chiefly confined to hilly belt with the exception of arecanut and coconut. Coffee and coconut are important crops from area point of view. Their distribution is shown in Table 6.

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Table 5

Cropping Patterns under A1 - A4 Categories.

Zone	Rainfall pattern	Cropping pattern
XII	D1 E3 (A1 B1 C2) C1 E3	Pd1 Pd4 R4 F4 JK5
XIII	D1 E3 (A3 C1) C1 E3	Pd1 Pd2 L4/B4/M4/V4/F4
XIV	D1 E3 (A3 C1) C1 D1 E2	Pd1 Pd2 L4/B4/M4/V4/F4
XV	D1 E3 (A3 B1) C1 E3	Pd1
XVI	D1 E3 (A3 B1) C1 D1 E2	Pd1 Pd2 L4/B4/M4/V4/F4 L2 Pd3 L3 Pd3
XVII	D1 E3 (A4) C1 D1 E2	Pd1 Pd2 L4/B4/M4/V4/F4
XVIII	D2 E2 (A2 B1 C1) C1 D1 E2	Pd2 L4/B4/V4/M4
XXI	C1 E3 (A4) C1 D1 E2	Pd1
XXII	C1 E3 (A4) B1 C1 E2	Pd1 Pd2 L4/B4/M4/V4/F4
XXV	C1 D1 E2 (A3 C1) C1 D1 E2	L2 Pd3 L3 Pd3
XXVI	C1 D1 E2 (A4) C1 D1 E2	L3 Pd3 L2 Pd3
	gross cropped area in these zones	= 7.8% of total gross cropped area of the State.

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Table 6
Area under Plantation Crops in the Producing Districts of Karnataka

(thousand hectares)

District	Pepper	Cardamom	Arecanut	Cashewnut	Coconut	Coffee	Tea	Rubber	Total actual	Total %of district gross cropped area	district gross cropped area
1.Coorg	0.7	10.9	0.5	0.6	0.4	44.4	0.2	1.1	58.8	46.4	126.7
2.Chikmagalur	-	3.8	6.1	0.1	16.6	42.4	1.7	0.1	70.8	29.0	243.9
3.Hassan	-	9.5	1.3	-	26.6	24.9	0.3	-	62.6	18.5	337.5
4.South Kanara	0.5	0.1	10.5	12.4	13.0	0.1	-	2.3	37.9	14.1	269.7
5.North Kanara	0.3	0.3	7.3	0.9	4.7	-	-	-	14.0	12.0	116.9
6.Tumkur	-	-	3.6	-	35.0	-	-	-	38.6	8.1	477.5
7.Chitradurga	-	-	2.2	-	14.1	-	-	-	16.3	3.2	512.7
8.Shimoga	0.1	-	7.4	2.6	0.5	0.1	-	-	10.7	3.1	341.8
9.Mandya	-	-	0.6	-	7.1	-	-	-	7.7	2.7	283.6
									317.4[a)]	11.7	2,710.3

a) = This represents 2.9 per cent of the total gross cropped area of the State.

Cropping Patterns of Zones with B Type of Rainfall

5.3 There are only 2 zones which begin with B type rainfall of the southwest monsoon season. These are:

Zone IV - E4 (B1 C3) D1 E3 - Gross cropped area 0.41 M ha
Zone XI - D1 E3 (B1 C2 E1) C1 E3 - " " " 0.28 M ha

In both the zones, B1 happens to be the month of July, but their characteristics with regard to cropping patterns differ because of their situation. The two are situated far apart. Zone IV is in the northern extreme covering parts of Bidar district and its cropping patterns are more in line with the contiguous zones II and III, which will be described in the next paragraph. Zone XI adjoins the leeside Zones XII and XVIII of the Ghat belt. Its cropping patterns are given below:

Pd1
Pd2 L4/B4/F4/M5/V4
Pd3 R4 L4/Pu4
R3 Pu4 Pd4/L4

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Although the rainfall in this zone is not directly adequate to support a crop of rice, yet it is found in varying proportions in all the cropping patterns. This is because of the proximity of hills from which the resulting downflow of water can be easily impounded. Because of elevations, plantation crops too figure in this zone, so also fodder grasses. Ragi appears in this zone in significant proportion in some cropping patterns; this happens in the southern taluks adjoining the main ragi belt.

Cropping Patterns of Zones with 'C' type of Rainfall in SW Monsoon Season

5.4 Rainfall Zones II to IV cover 13.9 per cent of gross cropped area in the northern districts of Bidar, Gulbarga and Raichur. Their patterns are mentioned below:

zone	rainfall pattern	cropping pattern
IV	E4 (B1 C3) D1 E3	Jr3 G4 Pu4 JK5 Pu4 G4 JK4 Jr4/Jr5 Mt5 Gn5 Pu4 T4 Jr4 Gn4 04/ Jk4 Pu4 Mt4 04 B4 Jr4
III	E4 (C4) D1 E3	Jr3 04 T4 Gn4/C4/B4 Pu4 T4 Jr4 Gn4 04/ JK4
II	E4 (C3 D1) D1 E3	C3 Jr4 Mt4/ Pd5 C4 Jr4 Jk4 Mt4/ Gn4/Pu4/B4 Jr4 Mt4 Gn4 Pu4

The monsoon rainfall in these zones is predominantly of C type and the month of October receives D type of rainfall. The amount of rainfall is not sufficient for high water requiring crops and, therefore, crops taken are millet group including jowar, pulses, groundnut and other oilseeds during kharif in general. Cotton figures in heavy soils but not prominently. Another deep rooted crop, namely, pigeonpea (tur) is also grown. Because of C and D types of rainfall respectively in the consecutive months of September and October, rabi jowar is also taken in varying proportions. It is important in many taluks of the two northern districts of Bidar and Gulbarga where it occurs in 30 to 50 per cent of the gross cropped area. Another crop in rabi which significantly occurs in Bidar in some of the cropping patterns in the range of 10 to 20 per cent area, is gram. It is significant to note that

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the crops chosen for rabi are such that they could carry through with stored soil moisture. The rainfall of November onwards is very meagre.

5.5 The rainfall pattern of Zone X is D1 E3 (C3 D1) C1 E3. It occupies 1.8 per cent of the gross cropped area. In this case too, the rainfall of the monsoon months of July to August is of C type. However, the month of October also receives C type of rainfall instead of D as in the case in Zones II to IV. This zone represents a narrow strip adjoining to Zone XI and covers parts of 3 taluks of Shimoga district. Because of irrigation facilities, paddy figures significantly in the cropping patterns, which are mentioned below:

Pd1
Pd4 R4 JK4 Gn4 / Pu4
Pd4 C4 JK4 Mt4

Cropping Patterns in D2 E2 Rainfall Zones of SW Monsoon Season

5.6 The SW monsoon season is least useful from rainfall point of view in Zones V and XXIII representing parts of Chitradurga and Mysore districts and covering 2.4 per cent of cropped area. Their particulars are mentioned below:

zone	rainfall pattern	cropping pattern
V	D1 E3 (D2 E2) C1 D1 E2	C4 Mt4 Jr4 Jk4 Pu4 Pu4 Jk4 Mt4 B4/Gn4/R4 Gn4
XXIII	C1 D1 E2 (D2 E2) C1 D1 E2	Jk3 Pu4 R4/ Gn4 Jk4 Pu4 R4/Pd4/Gn5/Pd5

A somewhat redeeming feature of these zones is the rainfall of August to November which could be represented as D2 C1 D1 and read in the order of calendar months. Pulses like horsegram and *Dolichos lablab*, crops of millet group and even cotton and groundnut are preferred. Paddy can hardly be sustained by rainfall, but it is also taken to some extent in Zone XXIII under irrigation.

Cropping Patterns of the Remaining Areas

5.7 The gross cropped area in the rest of the State constitutes 66.5 per cent of the total. It comprises of eight rainfall zones. Zones I, VI and VIII cover partly or wholly the northern districts of Bijapur, Raichur, Belgaum, Dharwar and Bellary and Zones VII, IX, XIX, XX and XXIV the southern districts of Chitradurga, Chikmagalur, Tumkur, Kolar, Bangalore, Mandya, Hassan and Mysore. The rainfall of June and July is of D type, that of August is either D or C, whereas September rainfall is of C type. October and November are the other two succeeding months which have either C or D type of rainfall. These zones can be essentially grouped into two, viz., (a) with September rainfall mostly of C type and October rainfall of D type and (b) with September and October rainfall of C type and November rainfall of D type. The month of maximum rainfall in these areas is either September or October (September predominating). The rainfall of pre-monsoon months is predominatly of E type. Strategy of crop production is built with September as the key month. Even when kharif crops are taken, attempt is to take

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advantage of September-October rains for the late vegetative phase, otherwise reliance is on a good cropping season commencing with sowing in September. In light soils, kharif crops are taken and rabi crops are preferred in heavy soils. In medium soils, both kharif and rabi crops are taken depending upon the rainfall in early monsoon months.

5.8 Table 7 presents the cropping patterns of the above mentioned zones. In areas where the rainy season extends upto October, the emphasis is on cotton, jowar and groundnut during kharif (in light to medium soils) and jowar during rabi (in heavy soils). In Navalgund area of Dharwar even wheat assumes a significant proportion mainly because of heavy nature of soil, although this crop occupies a minor place in the cropping patterns in many other isolated pockets also. Ragi stands very conspicuously in many patterns in areas with C-D type of rainfall extending up to November. It suits very much to be fitted as a second crop after an early kharif crop in D1 C1 conditions of April-May. This practice is of recent adoption. Paddy figures in many patterns of both the groups, but it even constitutes a prominent component of some patterns specially in (b) group, where rainy season extends upto November. The rainfall in itself is not sufficient to sustain this crop. The tendency is to take this crop in places where tank water is available. Attempts are made to fit in many other crops like horsegram, pigeonpea, sesamum and niger. The proportion of crops is invariably within 10-20 per cent area range so that if failure occurs, it would not be extensive and at least a few crops could even then succeed according to rainfall and soil pecularities. This is an ample proof that the area under the eight zones under consideration is precarious from rainfall point of view. Because of the type of rainfall distribution, population in many significant stretches has low density and irrigation facility is scarce with the result that the land holdings are large and arable farming is such that it does not require intensive methods. There is a marked tendency to rear sheep and goats, which fits in with the overall circumstances.

Table 7

Cropping Patterns in Rainfall Zones accounting for 66.5 per cent of Gross Cropped Area

I E4 (C1 D3) D1 E3 VI D1 E3 (C1 D3) DI E3 VIII D1 E3 (C2 D2) C1 E3	VII D1 E3 (C1 D3) C1 D1 E2 IX D1 E3 (C2 D2) C1 D1 E2 XIX C1E3 (C1D1E2) C1D1E2 XX C1E3 (C2D2) C1D1E2 XXIV C1 D1 E2 (C1 D3) C1 D1 E2
area = 41.1%	area = 25.4%
September rainfall mostly C October " " D	September rainfall C October " C November " D
cotton	ragi
C3 Jr4 Mt4/Pd5 C3 W4 Jr4 C4 Jr4 Jk4 Mt4/Gn4/ Gn4 Pu4/B4/S4/Pd4 C4 Jk4 Gn4	R2 Pd4 R2 Pu4/Pd4Pu4/Pu4 Pd5/Pu4 M4 R3 Pu4 Pd4/L4 R3 Gn4 Pd4/Mt4/Pu4/Pu4 Pd4 R4 L4 Pu4 Mt4/Jk4/Pd4/Mt4 Jk4 Mt4 R4 Jk4 Pu4
jowar kharif	other crops with higher percentage
Jk4 C4 Gn4 R4/Pu4 Jk4 C4 Gn4 W4/Pu4 Pd4 Jr4 Jk4 Mt4 B4 Gn4/C4/C4 Pu4	C3 Jk4 Mt4 Jk3 Pu4 R4/Gn4 Gn3 B4 R4 L3 Pd3

jowar rabi

Jr3 B4 Gn4/C4
Jr4 B4 Jk4 Gn4/M4 W4

groundnut

Gn3 Jk4 C4/W4/Pu4
Gn4 Jk4 To4 S5
Gn4 Jr4 Jk4 B4/W4

others

Pd4 C4 Gn4 Pu4
B4 Jk4 M4 Pu4 Gn4
Pu4 Gn4 Mt4 Jk4 W4 C4
W3 C4 Jk4 Jr4

paddy

Pd4 R4 Jk4 Gn4/Pu4
Pd4 R4 Pu4/L4
Pd4 R4 Pu4 S4/Jk4

others

Jk4 Mt4 B4 Gn4/C4/C4 Pu4
Jk4 Pu4 R4 Pd4/Gn5 Pd5
Pu4 Jk4 Mt4 B4/Gn4/R4 Gn4

Yield Performance of Crops

5.9 Districtwise Relative Yield Index (RYI) for different crops of Karnataka is presented in Table 8. The performance of rice, sugarcane, jowar, maize, ragi, groundnut and sesamum is above the all-India average in varying degrees, but that of pigeonpea, gram, cotton and wheat is below average with State RYI being 71, 61, 53 and 30 respectively. The performance of bajra shows large variations with the State RYI of about 90. The success of crops like rice and sugarcane is due to irrigation and intensive care, otherwise the area represents a millet-cotton - groundnut economy.

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Table 8

Relative Yield Index(a) of Crops

district/ crop	Rice (b)	Rice (c)	Rice (d)	Jowar Kharif	Jowar Rabi	Bajra	Ragi	Maize	Wheat	Tur	Gram	Groundnut	Sesamum	Cotton	Sugarcane
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Bidar	161			134	83	111			39	87	71	84	81	52	187
Gulbarga	128	163		110	122	120	99		38	61	59	97	86	56	174
Bijapur	178	170		299	91	75		228	33	75	55	57	127	33	175
Raichur	287	290	143	111	151	88			37	61	69	93	102	59	188
Bellary	431	284	175	182	139	118	93	326	-	66		125		60	191
Belgaum	124			159	117	67	64	220	28	78	52	85		44	150
Dharwar	106		69	203	108	113	65		25	80	49	81		58	174
Chitradurga	240	154	98	247	238	83	109	203		85	67	96	196	57	146
Tumkur	131	217	78	204		104	102			86		97			173
Kolar	137	124		303		97	102	282		78		97			176
Bangalore	122	119	78	358			105	371		82		101	192		232
Shimoga	182	142	160	232			80			74		131		53	164
Chikmagalur	185		112	132			106			291		144	168		194
Hassan	157	147	101	171			84	287		76	146	146			195
Mandya	198	210	130	216	160		94			78		146	167		182
North Kanara	152	139													165
South Kanara	133	146	85												181
Coorg		165					95								
Mysore		218		124			104	317		75	54	160	168	53	185
State RYI	159	189	121	172	116	88	99	262	30	71	61	92	130	53	175
all-India Yield in quintals/ha	10.4	10.9	15.9	5.5	4.4	4.6	7.9	10.8	12.3	7.0	6.7	7.4	2.0	1.2	501.0

Notes (a): RYI=Relative Yield Index = District/State yields expressed as percentage of all-India average yield for 168-69 to 1970-71

Counn (2)=Summer-sown (3)=Kharif (4)=Winter sown

6 Guidelines for Future Cropping Patterns

6.1 The work on formulation of future cropping patterns will consisit of following five stages:-

i) Delineation of rainfall patterns

ii) Identification of the existing cropping patterns

iii) Assessment of area needed for each crop for national self-sufficiency and the ideal locations for its distribution.

iv) Juxtaposition of (iii) over (ii) for studying them together with (i) in order to determine possible changes.

v) Consideration of related factors like soil, irrigation, pressure of population, needs of livestock, proportion of forest vegetation, cropped area & c., and then arriving at the future cropping patterns on the basis of (iv).

The scope of our study envisages ultimately the inclusion of all the five steps. Information on rainfall patterns, existing cropping patterns and related factors was presented in a Working Paper for discussion with the officials of Government of Karnataka. It was also considered advantageous to set in motion the process of thinking at the State level independent of the efforts initiated by the Commission.

6.2 A summary of questions posed by the Commission to the States is given below:

i) Are existing cropping patterns efficient from agronomic as well as economic point of view?

ii) If change is necessary, which are the areas where changes should be made?

iii) In the case of existing cropping patterns being acceptable at some places; what is the scope for increasing the production level and how?

iv) At the place where change is desired, what substitute crops will be recommended? The changes have to be indicated separately for rainfed and irrigated conditions taking into consideration the soil factor.

A Committee of Experts drawn from various Departments of Government of Karnataka and the University of Agricultural Sciences, Bangalore was constituted under the Chairmanship of the Director of Research of the University to consider various points which emerged from a discussion of the Working Paper. The results of their deliberations were published.[1]

6.3 The prognosis of an all-India character has primarily to ensure that the area and yield levels envisaged should be in the context of the needs of the country. This can obviously be done at the national level only for the major crops, but in this process many other equally vital crops, which either occupy less area or are of local importance only, are left out. These crops are: bast fibres, sugarcane, tobacco, potato, vegetables, various condiments and spices, fruits and plantation crops. Moreover, full justice cannot be done in a broad national prognosis to local edaphic, ecological, economic and social factors. It is therefore necessary to evolve cropping patterns from the lowest level. This would be a long drawn process for which we have made a beginning. Even when local experts have developed the patterns, these have to pass the test of time in actual practice and might require repeated

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1. Cropping Pattern from Different Rainfall Patterns and Agro-Climatic Regions of Mysore State, UAS, Tech. Series October 1973, the University of Agricultural Sciences, Hebbal, Bangalore - 560024.

modifications. Thus the process of determination of future cropping patterns would be a continuous one spread over a long time span till a fair degree of stability is achieved. It will be difficult to fix proportions of various crops in the overall crop mix with the same degree of preciseness as in the case of existing cropping patterns. We intend to lay down in our present study, principles and guidelines for this long drawn out process of evolving suitable cropping patterns over time.

6.4 At the outset, it is necessary to state that the cropping patterns will have to be thought of separately for the irrigated and unirrigated area. If this is done, many crops, which occupy minor proportions of area, may come out prominently in the irrigated cropping patterns and if so, it would automatically suggest a corrective to any lopsided allocation of water. Salient points pertaining to some crops, which could be considered in future crop planning in Karnataka are mentioned below:

Rice

i) The rice area of the State falling in different rainfall categories of the SW monsoon season is indicated below:

rainfall category	% State rice area
A4/A3	33
A1/B2	14
B1 or less	53

But for 33 per cent of rice area which falls in the coastal strip, the rainfall by itself is not sufficient to support this crop in the State and certainly not so in about half the area covered by 'B1 or less' categories. Kharif sown crop accounts for about 92 per cent of area and winter sown crop 8 per cent. The summer sown crop is also found scattered here and there, but the percentage area is less than one. Both high and low lying areas are covered under paddy. High lying areas suffer considerably due to long breaks and as a result, yields are low. It is specially so in drilled paddy tract of the State. It is obvious that water from all possible sources is being diverted to raising of this crop. The contours of the State are such that the impounding of water is made possible in many areas. Even taking note of this fact and making allowance for the low lying situations, there is considerable scope for making a reduction in rice area; the area could profitably be stabilised around 1 M ha. Barring the coastal strip and valley situations, the crop could be kept confined to the low lying positions in command areas of tanks. The upper reaches of command areas of tanks can be released with advantage for other crops.

Maize

ii) The area under maize has gone up from 6,000 hectares to more than 100,000 hectares and yield levels have been among the highest in the country. There is considerable scope for replacing paddy in high lying areas with maize. It does well under irrigation both in kharif as well as rabi seasons in most parts of the State.

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Cotton

iii) The eight districts which grow cotton in 10,000 ha or more are Bidar, Gulbarga, Belgaum, Bijapur, Raichur, Dharwar, Bellary and Chitradurga. The SW monsoon rainfall is B1 C3 in Bidar, B1 C3 or C2 D2 in parts of Dharwar, C4 in Belgaum and Gulbarga, C2 D2 in Bijapur and, C1 D3 in Raichur, Bellary and Chitradurga. But for about 10 per cent irrigated area in Belgaum irrigation for the crop is nominal. The crop performance in relation to all-India average varies between 33 and 60 per cent. It is no point taking the crop rainfed under the prevalent rainfall conditions. The area under rainfed cotton in scarcity areas could be diverted to more remunerative oilseed crops like safflower and rape-mustard. Rainfed cotton could be retained in assured rainfall zones and better practices developed. For getting higher yields, it should receive irrigation support. From the national point of view there is need and scope for increasing irrigated cotton area. The coverage can be increased from the present 1 M ha to 1.5 M ha with 70 % of it at least under irrigation. In recent years, performance of new hybrids of cotton under irrigation is noted to be very promising and highest yields ever obtained in the country are being reported from Bellary and Raichur districts. The possibility of shifting the irrigated crop to more assured parts of the State and bringing considerably larger area i.e. about 1 M ha under irrigation should therefore be examined. Insofar as the water availability is concerned, it is probably not going to be a problem.

Sugarcane

iv) Karnataka has to play a significant role in sugarcane production also because of its high yield potential. The present area is only 0.1 M ha; it could be increased to 0.4 M ha and all of it will have to be irrigated.

Other crops

v) The existing area of potato is 9,000 ha; possibility of increasing it to 20,000 ha is worth considering.

vi) The needs of green fodder, vegetables, flowers and fruits are going to so increase that every village should be able to set apart at least 30, 2, 1 and 7 ha respectively on an average. In practice the proportion of area may vary from place to place depending upon various factors, but the central point not be overlooked is that all perishable commodities should be produced as near the place of consumption as possible.

vii) Some new crops like sunflower and soyabean can be introduced with advantage in rainfed as well as irrigated areas. Soyabean is likely to do well in humid transitional belt in rotation with maize and sunflower all over the low rainfall areas in light as well as heavy soils.

viii) Karnataka has good scope for increasing its area under tapioca from the present level of 500 ha to 125,000 ha. It can take up cacao in about 4,000 ha. South Kanara and adjoining

> parts offer a promise for extension of rubber plantation. The State offers scope for increasing its cashew area too. No doubt that all these crops will be taken in the high rainfall areas towards the Ghats, yet there will be pressure on irrigation resources too for raising nurseries and tending young plantations.

6.5 There is considerable need as well as scope for changing the cropping patterns in irrigated areas. The present emphasis on paddy can be reduced and other crops like cotton, oilseeds, pulses and forage crops could be introduced with advantage. In heavy rainfall zones and transitional belts, maize, cotton and oilseeds could be introduced especially in high lying areas in place of paddy. Maize and soyabean products will have increasing uses in expanding cattle feed and other industries. Maize has been catching the imagination of farmers in the State already. Research and development work on soyabean will have to be intensified to identify suitable areas for it in the State. In some parts of the State, double cropping is a distinct possibility even in rainfed areas, where two peaks of rainfall occur in May and September-October. Groundnut yields are low in light soils and the crop does not come up well in heavy soils, especially if saline. Sunflower has performed well under such conditions. Safflower has also performed well both under dry and irrigated conditions, specially in heavy soils. This crop could be a good substitute for wheat and cotton in dry areas and for wheat under irrigated conditions.

6.6 The scope for increasing production in certain dry areas of the State where existing cropping patterns might require no change over time has also to be examined.

For this purpose, besides increased use of various kinds of inputs, success would depend to a great extent upon the following two factors:

i) Better water management practices - Such practices would have to be developed and demonstrated. Farm ponds in every holding to store excess water for giving irrigation during critical periods are already proving popular in dry areas. Similar innovations should be developed, demonstrated and adopted.

ii) Appropriate land use planning - Alternative crops and their varieties will have to be tried and kept ready at hand for sowing according to the early or late arrivals of rains in different years. This cafeteria approach, which is already gaining ground amongst agronomists needs to be more intensively followed in future. For the success of this approach, a knowledge of optimum time of sowing of different crops in relation to the most likely dates of commencement of the rainy spells of required amounts is very necessary. A study of this type has been initiated recently in the India Meteorological Department, which could be given a trial in some selected areas when completed.

The agricultural scientists would have to be constantly busy formulating and trying cropping patterns on the above principles, which in course of time would assume relative stability. Evolution of cropping patterns has to be a gradual process of adjustment. A befitting example is that of groundnut, which was not a significant crop in the country even during the thirties of the century, but India has now become one of the leading groundnut producing countries of the world. The only difference is that such changes have been gradual, few and far between in the past, but now more expeditious and deliberate efforts have to be made with a view to make the country self-reliant as quickly as possible.

Annexure I

Statement I - Districtwise Frequency Distribution of Areas of Taluks in Different Class Intervals of Area

District	Number of taluks with area (sq km) of					Total no. of taluks
	less than or equal to 500	501-1000	1001-1500	1501-2000	2001-3000	
1. Bangalore	2	8	-	1	-	11
2. Belgaum	-	2	4	4	-	10
3. Bellary	1	2	3	2	-	8
4. Bidar	-	2	3	-	-	5
5. Bijapur	-	3	4	1	3	11
6. Chikmagalur	1	2	3	1	-	7
7. Chitradurga	1	3	3	1	1	9
8. Coorg	-	1	1		-	3
9. Dharwar	2	11	4	-	-	17
10. Gulbarga	-	1	2	7	-	10
11. Hassan	1	4	3	-	-	8
12. Kolar	1	10	-	-	-	11
13. Mandya	1	5	1	-	-	7
14. Mysore	1	6	2	1	1	11
15. N.Kanara	1	7	2	1	-	11
16. Raichur	-	-	4	5	-	9
17. Shimoga	-	3	5	1	-	9
18. S.Kanara	-	5	2	1	-	8
19. Tumkur	-	4	5	1	-	10
Total	12	79	51	28	5	175
Percentage of total	6.9	45.1	29.1	16.0	2.9	

Annexure 1

Statement II - Mean Daily Temperature (°C) for Observatories in Karnataka

Station	January	February	March	April	May	June	July	August	September	October	November	December	annual
1. Karwar	24.7	24.8	26.7	28.5	28.9	27.1	26.0	26.0	26.1	26.7	26.3	25.8	26.5
2. Honavar	26.0	25.9	27.3	28.8	29.1	26.7	25.9	25.9	26.0	26.9	27.2	26.8	26.9
3. Mangalore(Bajpe)	26.8	27.3	28.3	29.3	28.4	26.1	25.3	25.4	25.6	26.5	27.1	26.7	26.9
4. Mangalore	26.6	27.0	28.1	29.3	29.1	26.7	26.0	26.1	26.1	26.9	27.2	26.8	27.1
5. Bidar	22.4	24.9	28.3	30.7	32.3	28.1	25.2	24.9	24.9	25.1	23.0	21.7	26.0
6. Gulbarga	23.2	26.0	29.3	32.1	33.3	29.4	27.0	26.7	26.5	26.5	24.0	22.3	27.2
7. Bijapur	23.2	25.5	28.7	30.9	31.2	27.9	25.9	25.7	25.9	25.8	23.6	22.1	26.4
8. Raichur	24.4	26.9	30.2	32.5	33.1	29.6	27.5	27.4	27.2	27.1	25.1	23.6	27.9
9. Belgaum	22.1	23.7	26.5	27.6	27.3	24.1	22.5	22.5	23.0	24.4	23.2	21.6	24.1
10. Belgaum(Sambre)	22.1	23.8	26.5	27.3	27.1	24.6	22.8	22.5	23.1	23.8	22.6	21.9	24.0
11. Gadag	23.5	25.8	28.5	29.9	29.6	26.5	24.9	24.9	25.1	25.5	24.1	22.8	26.0
12. Bellary	24.0	26.6	29.7	31.3	31.9	29.2	27.8	27.5	27.3	26.8	24.8	23.4	27.6
13. Chitradurga	23.0	25.6	28.2	29.5	28.7	26.0	24.9	24.3	24.7	25.0	23.4	22.4	25.5
14. Shimoga	22.6	24.5	27.2	29.0	28.2	25.4	24.0	24.1	24.3	24.8	23.2	21.7	24.9
15. Balehonnur	21.1	22.6	24.4	25.0	24.5	22.0	20.6	20.9	21.3	22.0	21.3	20.6	22.2
16. Hassan	21.4	23.2	25.6	26.7	25.9	23.1	21.9	22.2	22.6	23.1	22.0	20.9	23.3
17. Bangalore	21.0	23.1	25.7	27.3	26.9	24.3	23.2	23.3	23.3	23.2	21.8	20.5	23.6
18. Bangalore (Airport)	21.7	23.5	26.0	27.7	27.1	24.8	23.6	23.7	24.0	23.8	22.5	21.2	24.1
19. Mysore	22.4	24.7	26.9	27.7	26.9	24.6	23.5	23.8	24.0	24.0	22.9	21.8	24.4
20. Mercara	19.4	21.0	22.6	22.9	22.3	19.7	18.7	18.9	19.5	20.4	19.9	19.5	20.3

Annexure 1

Daily

Statement III - Mean/Maximum Temperature (^{o}C) for Observatories in Karnataka

Station	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	annual
1. Karwar	30.5	30.8	30.9	31.6	31.5	29.4	28.0	27.9	28.4	29.7	31.6	32.1	30.2
2. Honavar	31.9	31.3	31.9	32.4	32.3	29.3	28.2	28.3	28.8	30.6	32.5	32.7	30.9
3. Mangalore (Bajpe)	32.5	32.3	33.0	33.7	32.2	29.1	27.8	28.0	28.6	30.0	31.8	32.3	31.0
4. Mangalore	31.4	31.1	31.7	32.4	32.1	29.4	28.5	28.5	28.7	29.8	31.1	31.7	30.5
5. Bidar	28.3	31.1	34.6	36.9	38.6	33.3	29.0	28.7	28.8	29.5	27.9	27.1	31.2
6. Gulbarga	30.4	33.4	36.8	39.1	40.2	35.0	31.4	31.2	31.1	31.9	30.4	29.5	33.4
7. Bijapur	30.2	32.9	36.0	38.0	38.5	33.3	30.1	30.1	30.6	31.0	29.7	29.0	32.5
8. Raichur	30.2	33.2	36.6	38.7	39.6	35.1	32.0	31.9	31.6	31.7	30.1	29.1	33.3
9. Belgaum	30.1	32.2	35.0	35.7	34.0	27.5	25.2	25.6	27.0	30.1	29.3	29.3	30.1
10. Belgaum(Sambre)	29.0	31.5	34.3	35.2	33.3	28.7	25.4	25.2	26.9	28.3	28.2	28.2	29.5
11. Gadag	30.3	33.0	36.0	37.3	36.5	31.1	28.5	28.9	29.7	30.8	29.8	29.1	31.8
12. Bellary	30.3	33.3	36.4	38.1	37.9	33.7	31.5	31.4	31.5	31.3	29.9	29.3	32.9
13. Chitradurga	28.9	32.0	34.9	36.3	35.1	30.6	28.1	28.1	29.1	39.6	28.4	28.0	30.8
14. Shimoga	30.5	32.9	35.3	35.7	33.8	29.0	26.8	27.1	28.6	29.2	29.1	28.9	30.6
15. Balehonnur	27.3	29.3	31.3	30.9	29.4	25.1	22.7	23.2	24.5	26.1	26.2	26.2	26.9
16. Hassan	28.1	30.5	32.9	33.2	31.5	26.8	24.8	25.5	26.7	27.6	27.0	26.8	28.5
17. Bangalore	26.9	29.7	32.3	33.4	32.7	28.9	27.2	27.3	27.6	27.5	26.3	25.7	28.8
18. Bangalore (Airport)	28.0	30.6	33.2	34.0	32.9	29.7	27.8	27.9	28.6	28.3	27.5	26.9	29.6
19. Mysore	28.3	31.2	33.5	34.0	32.6	28.9	27.3	27.9	28.7	28.4	27.4	27.0	29.6
20. Mercara	24.6	26.8	28.5	27.9	26.3	21.9	20.2	20.7	22.0	23.7	23.6	23.5	24.1

Annexure 1

Statement IV - Daily Mean/Minimum Temperatrre (°C) for observatories in Karnataka

Station	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	annual
1. Karwar	18.9	18.7	22.5	25.3	26.3	24.8	24.0	24.1	23.8	23.6	20.9	19.4	22.7
2. Honavar	20.0	20.5	22.7	25.2	25.8	24.1	23.5	23.5	23.2	23.2	21.9	20.9	22.9
3. Mangalore (Bajpe)	21.0	21.8	23.5	24.9	24.6	23.1	22.7	22.8	22.6	22.9	22.3	21.1	22.8
4. Mangalore	21.7	22.8	24.5	26.1	26.0	23.9	23.5	23.6	23.5	23.8	23.2	21.9	23.7
5. Bidar	16.5	18.7	21.9	24.5	26.0	22.9	21.3	21.0	21.0	20.6	18.0	16.2	20.7
6. Gulbarga	16.0	18.5	21.7	25.0	26.3	23.8	22.5	22.2	21.9	21.0	17.5	15.1	21.0
7. Bijapur	16.2	18.1	21.3	23.8	23.9	22.4	21.7	21.3	21.1	20.6	17.4	15.2	20.3
8. Raichur	18.5	20.5	23.7	26.2	26.5	24.1	22.9	22.8	22.7	22.5	20.0	18.0	22.4
9. Belgaum	14.0	15.1	18.0	19.5	20.6	20.6	19.8	19.4	19.3	18.6	17.1	13.9	18.0
10. Belgaum (sambre)	15.2	16.1	18.6	20.3	20.8	20.5	20.1	19.8	19.2	19.3	16.9	15.5	18.5
11. Gadag	16.7	18.6	21.0	22.5	22.6	21.9	21.2	20.9	20.5	20.2	18.4	16.5	20.1
12. Bellary	17.6	19.9	22.9	25.5	25.8	24.7	24.0	23.5	23.0	22.3	19.6	17.4	22.2
13. Chitradurga	17.1	19.2	21.5	22.7	22.3	21.4	20.8	20.5	20.3	20.3	18.4	16.7	20.1
14. Shimoga	14.6	16.1	19.1	22.2	22.5	21.7	21.1	21.0	20.5	20.3	17.3	14.4	19.2
15. Balehonnur	14.8	15.8	17.5	19.0	19.5	18.8	18.5	18.6	18.1	17.9	16.4	14.9	17.5
16. Hassan	14.7	16.1	18.2	20.1	20.3	19.4	18.9	18.8	18.4	18.6	16.9	15.0	18.0
17. Bangalore	15.0	16.5	19.0	21.2	21.1	19.7	19.2	19.2	18.9	18.9	17.2	15.3	18.4
18. Bangalore (Airport)	15.3	16.4	18.7	21.3	21.2	19.9	19.3	19.4	19.3	19.3	17.4	15.4	18.6
19. Mysore	16.4	18.2	20.2	21.4	21.2	20.2	19.7	19.6	19.3	19.6	18.3	16.5	19.2
20. Mercara	14.2	15.1	16.6	17.9	18.3	17.4	17.1	17.1	16.9	17.0	16.1	14.6	16.5

Annexure

Statement V - Normal Monthly and Annual Potential Evapotranspiration (PE) for selected Observatories in Karnataka

(mm)

Station	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	an
1. Karwar	106	110	144	141	128	91	83	87	95	100	105	103	12
2. Honavar	121	121	146	141	134	93	92	94	96	106	112	118	1
3. Mangalore (Bajpe)	140	141	169	162	132	95	90	92	98	105	113	127	14
4. Mangalore	136	136	164	154	141	96	91	95	100	109	116	128	14
5. Bidar	122	138	184	192	217	173	135	128	116	127	114	109	1
6. Gulbarga	125	144	191	210	235	155	152	143	131	146	130	118	1
7. Bijapur	109	123	165	180	197	157	137	135	124	123	102	97	16
8. Raichur	132	145	193	202	224	139	170	164	143	142	126	121	1
9. Belgaum	113	125	167	171	172	114	92	95	100	117	110	106	14
10. Belgaum (Sambre)	137	154	197	195	192	142	111	107	112	117	123	129	1
11. Gadag	121	131	173	179	184	145	130	131	123	123	113	112	16
12. Bellary	115	129	171	181	195	167	156	153	138	123	106	104	1
13. Chitradurga	124	134	172	171	172	133	121	120	119	117	107	111	16
14. Shimoga	109	118	153	153	145	110	95	98	101	101	99	99	1
15. Hassan	111	119	157	149	146	111	110	104	106	105	98	100	14
16. Bangalore	117	130	166	158	157	127	116	114	109	105	93	103	1
17. Mysore	123	134	166	154	148	124	116	117	117	111	106	114	1

Annexure 1

Statement VI - Irrigation Statistics

District	irrigated area as % of cropped area (gross)					% of net irrigated area served by differen sources			
	for distt. as a whole	number of taluks with irrigated area of				canals	tanks	wells	ot so ces
		10% or less	10.1%-20%	20.1%-50%	greater than 50%				
Gulbarga	2	10	-	-	-	2.5	28.6	54.5	14.
Bidar	3	5	-	-		-	8.4	85.6	6.
Bijapur	4	10	-	-	-	18.3	11.6	67.9	2.2
Dharwar	5	13	3	1	-	11.0	70.2	11.3	7.5
Coorg	7	2	1	-	-	45.6	30.1	-	24.3
Bellary	10	6	2	-	-	67.0	14.7	16.2	251
Belgaum	11	4	5	1	-	32.6	9.5	46.3	11.6
Raichur	11	6	2	1	-	86.7	2.6	10.0	0.7
Chikmagalur	13	4	2	1	-	29.6	61.6	4.8	4.0
Mysore	14	4	5	2	-	64.9	20.4	12.8	1.9
Tumkur	16	2	5	3	-	1.3	50.0	40.3	8.4
Bangalore	17	-	8	3	-	4.3	53.2	38.2	4.3
Hassan	18	1	2	5	-	14.7	63.4	4.4	17.5
N.Kanara	18	4	4	3	-	6.6	56.4	6.3	30.7
Chitradurga	19	4	3	1	1	58.1	24.8	16.5	0.6
Kolar	26	-	2	9	-	1.5	51.9	46.2	0.4
S.Kanara	32	-	2	6	-	-	18.0	22.1	5.9
Mandya	34	-	1	5	1	75.0	16.2	6.6	2.2
Shimoga	51	-	-	4	5	43.3	45.8	1.8	9.1
State	12	75	48	45	7	34.8	32.5	22.8	9.9

Annexure

Statement VII - Land Use Statistics - Percentage of Reporting Area (1969-70)

districts	forests	land put to non agricultural use	barren and un-cultivable land	total of 3 and 4 not available for cultivation	cultivable waste	permanent pastures and other grazing lands	land under miscellaneous trees, crops and groves	total of 6, 7 & 8-other uncultivated land	current fallow	other fallow lands	total of 10 & 11-	net area sown	area sown more than once as per cent of net sown area
1.	2.	3.	4.	5.	6.	7.	8.	9	10.	11.	12.	13.	14.
1.Bangalore	10.5	8.3	5.5	13.8	2.1	14.4	1.8	18.3	6.0	0.2	6.2	51.2	2.1
2.Belgaum	14.2	3.1	3.8	6.9	1.6	1.9	0.1	3.6	3.6	1.5	5.1	70.2	2.1
3.Bellary	12.3	7.6	6.5	14.1	4.3	1.0	0.6	5.9	4.3	2.0	6.3	61.4	3.1
4.Bidar	1.8	5.4	3.1	8.5	2.1	4.7	4.5	11.3	7.7	9.4	17.1	61.3	21.6
5.Bijapur	4.9	2.6	3.0	5.6	0.5	1.0	0.1	1.6	2.6	1.6	4.2	83.7	1.3
6.Chikmagalur	24.5	4.2	5.3	9.5	4.4	22.1	1.6	28.1	3.3	2.9	6.2	31.7	8.0
7.Chitradurga	7.9	5.4	3.7	9.1	5.1	13.2	1.3	19.6	9.4	10.7	20.1	43.3	9.7
8.Coorg	33.0	7.1	5.6	12.7	9.6	5.9	9.7	25.2	0.1	0.4	0.5	28.8	8.3
9.Dharwar	8.3	1.6	2.0	3.6	0.6	2.8	0.3	3.9	1.8	1.5	3.3	80.9	2.2
10.Gulbarga	4.4	2.9	5.2	8.1	1.4	3.6	0.2	5.1	5.6	1.3	7.0	75.4	3.5
11.Hassan	3.7	8.0	4.1	12.1	5.3	15.2	1.0	21.5	9.9	5.5	15.4	47.3	9.5
12.Kolar	9.4	8.3	6.3	14.7	1.9	25.8	1.7	29.4	6.1	2.3	8.3	38.2	2.3
13.Mandya	4.9	10.2	3.5	13.7	10.6	11.6	0.3	22.5	4.2	1.3	5.4	53.6	9.0
14.Mysore	26.3	5.1	6.4	11.5	3.5	14.4	1.1	19.0	1.9	4.0	5.9	37.3	18.1
15.North Kanara	81.4	1.7	1.7	3.5	1.3	1.3	0.3	3.3	0.5	1.0	1.4	10.5	10.6
16.Raichur	2.0	3.1	4.4	7.5	1.1	3.4	0.8	5.4	7.4	4.3	11.8	73.3	1.8
17.Shimoga	20.7	7.0	3.7	10.7	4.9	25.2	1.9	31.9	2.3	5.2	7.5	29.2	12.6
18.South Kanara	29.4	8.3	8.7	17.0	9.2	4.0	11.4	24.6	4.2	2.2	6.4	22.6	42.5
19.Tumkur	4.3	6.0	5.0	11.0	7.1	13.5	2.4	23.1	11.7	6.4	13.0	43.6	2.8
State	15.1	4.5	4.9	9.4	3.3	8.6	1.6	13.6	4.3	3.3	8.1	53.8	5.8

Annexure 1

Statement VIII - Frequency of Taluks in Different Ranges of Population Density

density per sq km

District	Less than or equal to 50	51-100	101-150	151-200	201-300	301-500	greater than 500	No. of taluks	Dist. density per sq km
1. Bangalore	-		1	2	5	2	1	11	319
2. Tumkur	-		5	4	1	-	-	10	153
3. Chitradurge		4	2	1	2	-	-	9	129
4. Bellary		4	2	1	1	-	-	8	111
5. Coorg		2	1	-	-	-	-	3	92
6. Chikmagalur		3	4	-	-	-	-	7	102
7. Belgaum		1	3	3	2	1	-	10	180
8. Bijapur		3	6	2	-	-	-	11	116
9. Dharwar		1	8	7	-	-	1	17	170
10. Bidar		-	3	2	-	-	-	5	151
11. Gulbarga		4	5	1	-	-	-	10	109
12. Hassan		1	2	4	1	-	-	8	161
13. Kolar		-	3	5	2	1	-	11	185
14. Mandya		-	1	1	3	2	-	7	232
15. Mysore		3	1	3	2	1	1	11	168
16. North Kanara	2	5	2	1	1	-	-	11	83
17. Raichur		6	3	-	-	-	-	9	102
18. Shimoga		3	3	2	1	-	-	9	123
19. South Kanara		1	1	3	-	2	1	8	235
	2	41	56	42	21	9	4	175	153
Percentage to total	1.2	23.4	32.0	24.0	12.0	5.1	2.3		

Annexure I

Statement IX – Percentage of Operational Holdings and Area Operated

District	no. of holdings (thousand)	area of holdings (thousand ha)	0.1 to 2.0 ha		2.1 to 5.0 ha		5.1 to 20.0 ha		20.1 ha and above	
			per-cent hold-ings	per-cent area	per-cent hold-ings	per-cent area	per-cent hold-ings	per-cent area	per-cent hold-ings	per-cent area
1. North Kanara	106.2	147.3	77.6	31.0	16.9	37.4	5.3	29.5	0.2	1.8
2. South Kanara	129.9	205.9	75.4	39.6	20.0	36.8	4.4	21.2	0.1	2.3
3. Belgaum	208.3	971.5	52.2	14.2	28.4	27.7	18.3	48.6	1.1	9.5
4. Dharwar	268.6	1128.7	38.0	10.4	35.2	26.8	25.4	53.6	1.5	9.3
5. Shimoga	147.2	325.6	64.0	28.6	27.2	37.0	8.4	30.1	0.3	4.4
6. Chikmagalur	92.0	243.8	59.6	22.0	28.6	32.1	10.8	32.8	1.2	13.0
7. Hassan	166.7	359.9	64.9	28.2	26.7	37.3	8.0	29.2	0.4	5.4
8. Coorg	36.8	136.3	50.8	13.2	29.9	25.6	17.4	40.4	1.9	20.8
9. Bidar	87.6	479.4	30.4	6.1	32.3	19.4	34.1	58.1	3.3	16.6
10. Gulbarga	212.7	263.2	26.3	4.9	32.6	13.2	37.2	53.5	3.8	13.4
11. Bijapur	247.4	1454.6	25.4	5.0	33.8	18.8	37.3	59.2	3.5	16.9
12. Raichur	229.5	1121.5	30.2	7.0	36.5	24.2	31.3	56.5	2.2	11.9
13. Bellary	127.3	553.2	36.6	9.1	36.9	27.4	24.5	49.5	1.9	14.0
14. Chitradurga	177.3	705.3	41.7	11.5	35.0	27.5	21.5	47.8	1.8	13.2
15. **Tumkur**	235.3	613.5	67.7	26.7	22.9	32.4	8.9	34.2	0.5	6.7
16. Kolar	209.3	394.0	70.8	32.9	22.7	35.9	6.4	26.6	1.9	4.5
17. Bangalore	240.7	443.7	71.3	33.0	22.2	36.1	6.3	26.9	0.3	4.7
18. Mandya	215.3	294.6	78.9	42.5	17.7	33.1	3.3	18.2	0.1	1.2
19. Mysore	271.9	513.3	69.3	34.7	24.5	38.5	6.1	24.7	0.1	2.0
State	3551.0	11367.0	54.1	15.5	27.9	27.3	16.9	46.1	1.2	11.1

Annexure I

Statement X - Availability of Power (HP) per Hectare of Cultivated Area

District	Gross cropped area (ha)	Human	Animal	Tractors	Power tillers	Power sprayers -dusters	Diesel engines	Electric motors	Electrically operated sugarcane crushers	Total power
1.Bangalore	380043	0.0464	0.1145	0.0288	0.0029	0.0052	0.0155	0.5306	0.0082	0.5521
2.Belgaum	968279	0.0265	0.1020	0.0067	0.0003	0.0078	0.1069	0.0527	0.0085	0.3114
3.Bellary	304082	0.0206	0.0897	0.0077	0.0001	0.0032	0.0074	0.0620	0.0130	0.2057
4.Bidar	413317	0.0190	0.0733	0.0019	-	0.0064	0.0512	0.0913	0.0066	0.2497
5.Bijapur	147[illegible]	0.0146	0.0512	0.0042	0.0003	0.0030	0.0364	0.0456	0.0012	0.1565
6.Chikmagalur	231212	0.0343	0.2159	0.0155	0.0010	0.0206	0.0071	0.0453	0.0038	0.5435
7.Chitradurga	420048	0.0366	0.1700	0.0132	0.0006	0.0063	0.0097	0.1565	0.0036	0.3971
8.Coorg	116343	0.0392	0.2336	0.0249	0.0010	0.0131	0.0214	0.0401	0.0007	0.3740
9.Dharwar	1139295	0.0202	0.0838	0.0053	0.0001	0.0039	0.0084	0.0375	0.0027	0.1619
10.Gulbarga	1257151	0.0141	0.0677	0.0016	0.0003	0.0078	0.0163	0.0162	0.0015	0.1252
11.Hassan	328145	0.0341	0.1613	0.0085	0.0005	0.0065	0.0063	0.0358	0.0070	0.2500
12.Kolar	256032	0.0634	0.2280	0.0120	0.0024	0.0197	0.0118	0.5935	0.0152	0.9158
13.Mandya	271226	0.0438	0.1804	0.0026	0.0005	0.0022	0.0128	0.0997	0.0159	0.3579
14.Mysore	512024	0.0380	0.1727	0.0030	0.0014	0.0062	0.0051	0.0532	0.0019	0.3245
15.N.Kanara	124845	0.0651	0.3731	0.0072	0.0007	0.0247	0.0236	0.1093	0.0026	0.6036
16.Raichur	1046694	0.0158	0.0781	0.0107	0.0001	0.0049	0.0068	0.0255	0.0018	0.1440
17.Shimoga	323472	0.038[illegible]	0.2561	0.0163	0.0086	0.0188	0.0059	0.582	0.0129	0.4173
18.S.Kanara	272669	0.0654	0.31[illegible]4	0.0021	0.0045	0.0212	0.1549	0.5283	0.0016	0.8904
19.Tumkur	181577	0.0368	0.1477	0.0025	0.0012	0.0037	0.0198	0.2147	0.0045	0.4309
STATE	10588739	0.0269	0.1171	0.0073	0.00086	0.00705	0.02843	0.09003	0.00488	0.2826
per cent to total		9.5	41.5	2.6	0.3	2.5	10.1	31.8	1.7	

Notes:

1. Human population is based on 1971 census. Data on Draft animals and power appliances taken from 1972 Livestock Census.
2. Only 80% of the active agricultural population (ages 15-60) and draft animals and 50% of the tractors are considered for cultural operations.
3. Contribution in HP per unit assumed for different categories is: man = 0.06, bullock = 0.040 tractor = 25.0, power tiller = 7.0, power sprayer = 2.0, diesel engine = 7.0, electric motor = 6.0, electrically operated crushers = 6.0
4. Gross cropped area represents average of three years 1967-68 to 1969-70.

Annexure 2

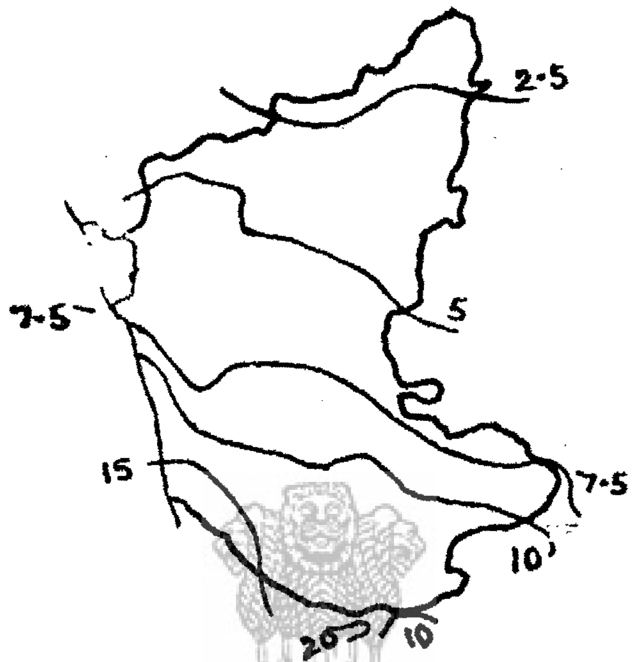
			number of pages
Maps	I - XIV	Rainfall and Coefficient of Variation May to October and Annual	7
	XV	Net Sown Area as per cent of Geographical Area	1
	XVI	Irrigated Area as per cent of Gross Cropped Area	1
	XVII	Density of Population (persons per sq km)	1
	XVIII	Total Power Available for Cultural Operations (per ha of cultivated area)	1
			11

सत्यमेव जयते

KARNATAKA

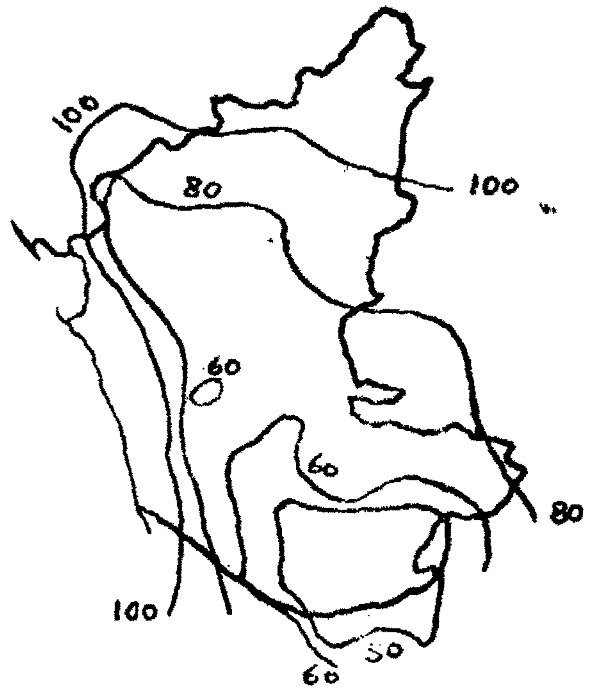
MAY

Rainfall Cm.



Coefficient of variation of Rainfall (percent)

II



Annexure 2

Maps I-II : Rainfall and Coefficient of Variation (CV) for the month of May.

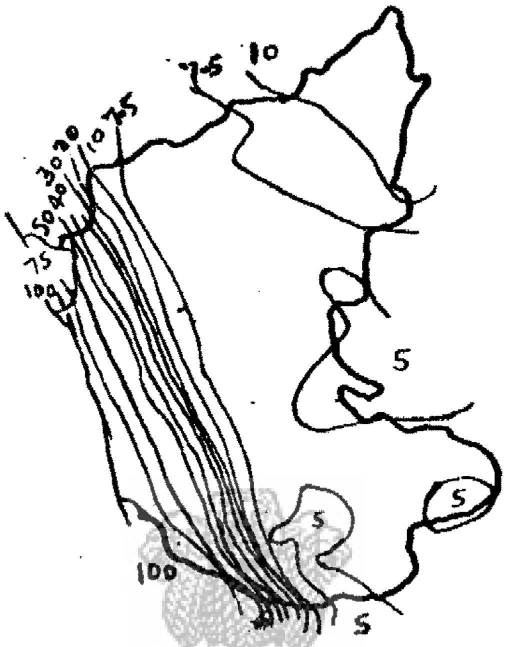
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line

KARNATAKA

JUNE

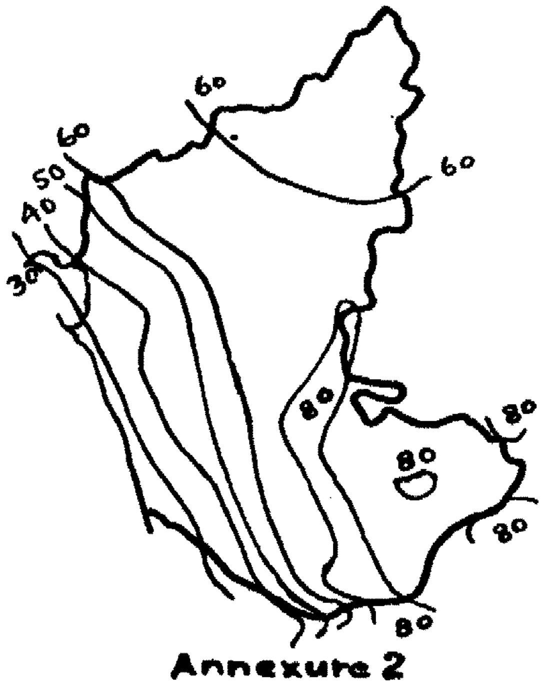
III

Rainfall Cm.



Coefficient of Variation of Rainfall (percent)

IV



Annexure 2

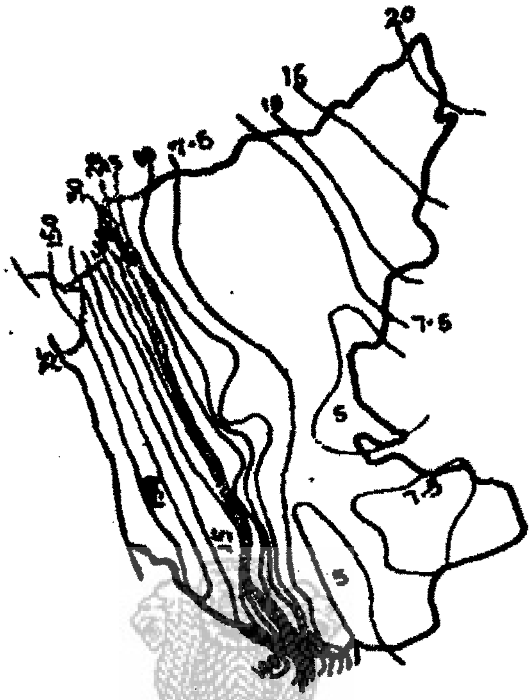
Maps III-IV: Rainfall and Coefficient of Variation (CV) for the month of June.

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

KARNATAKA

JULY

Rainfall Cm.



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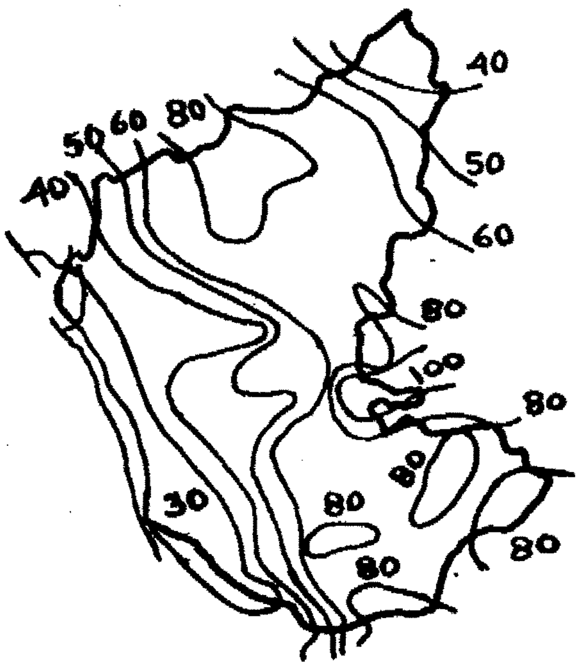
Coefficient of Variation of Rainfall(percent)



Annexure 2

Maps V-VI: Rainfall and Coefficient of Variation (CV) for the month of July.

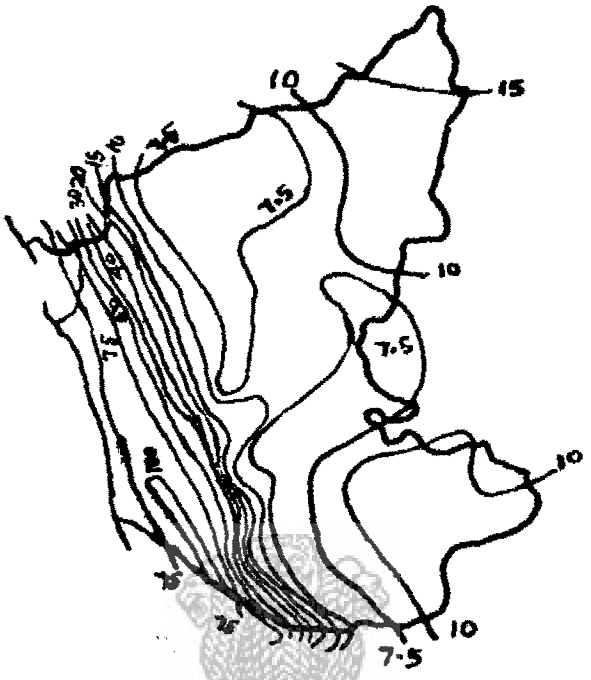
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

KARNATAKA

AUGUST

VII

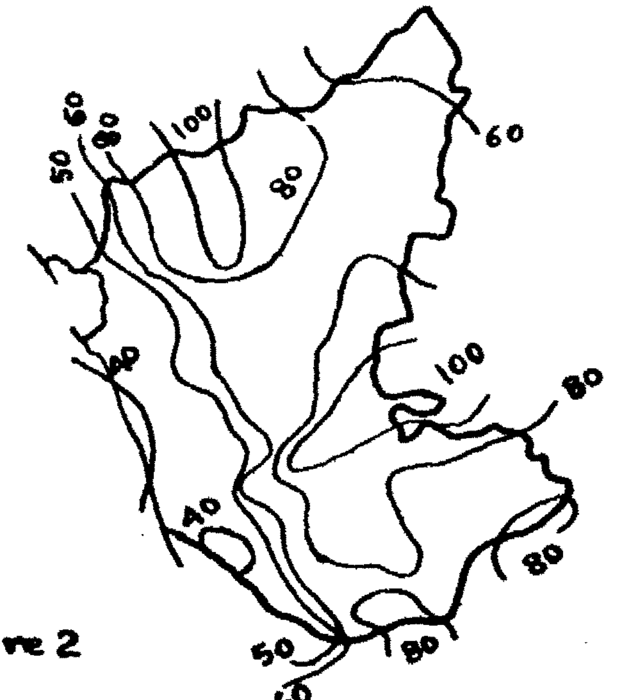
Rainfall Cm.



सत्यमेव जयते

Coefficient of Variation of Rainfall(percent)

VIII



Annexure 2

Maps VII-VIII: Rainfall and Coefficient of Variation (CV) for the month of August.

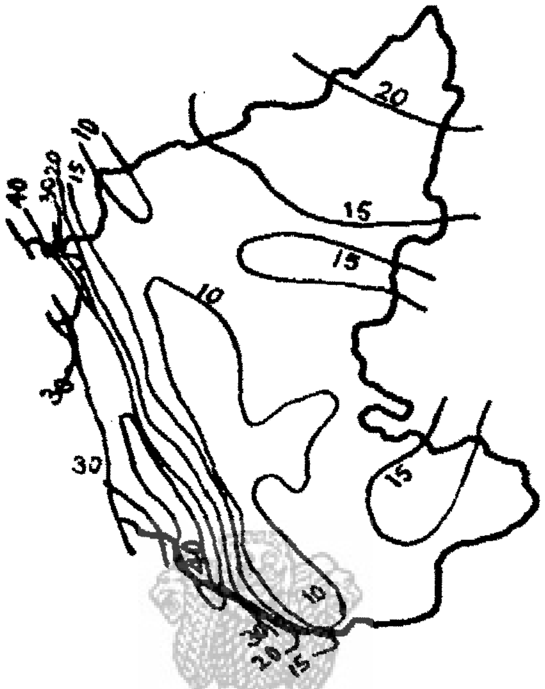
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

KARNATAKA

SEPTEMBER

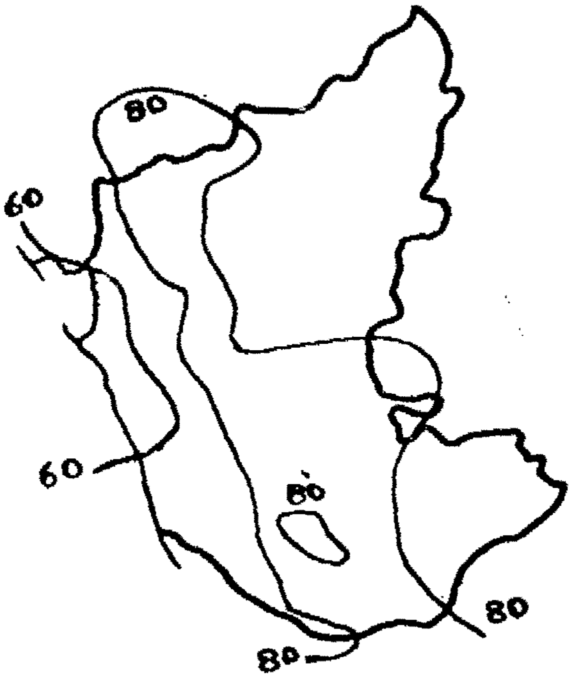
IX

Rainfall Cm.



Coefficient of Variation of Rainfall (percent)

X



Annexure 2

Maps IX-X: Rainfall and Coefficient of Variation (CV) for the month of September.

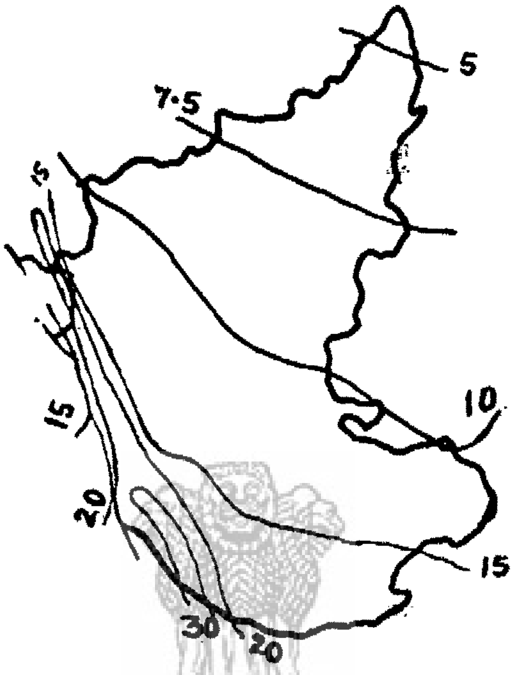
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line

KARNATAKA

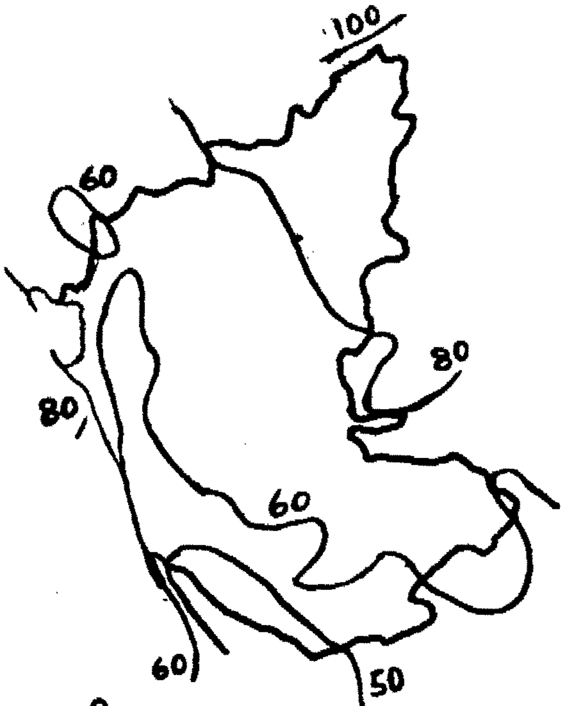
OCTOBER

XI

Rainfall Cm.



Coefficient of Variation of Rainfall (percent)



Annexure 2

Maps XI-XII: Rainfall and Coefficient of Variation (CV) for the month of October.

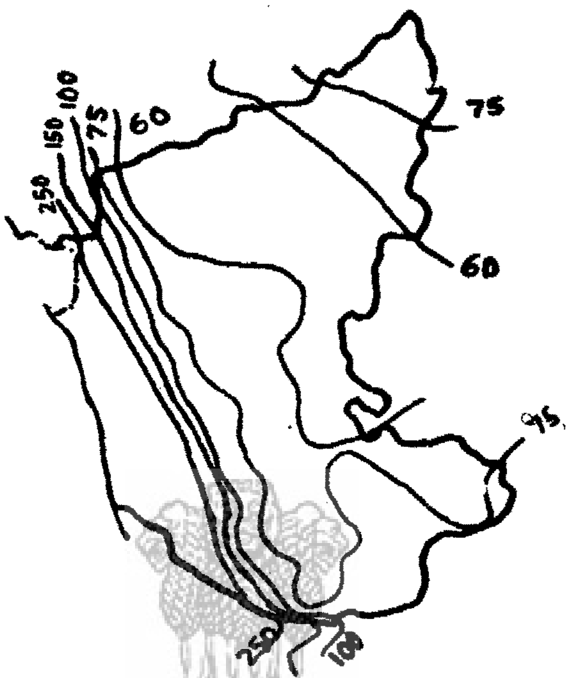
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

KARNATAKA

ANNUAL

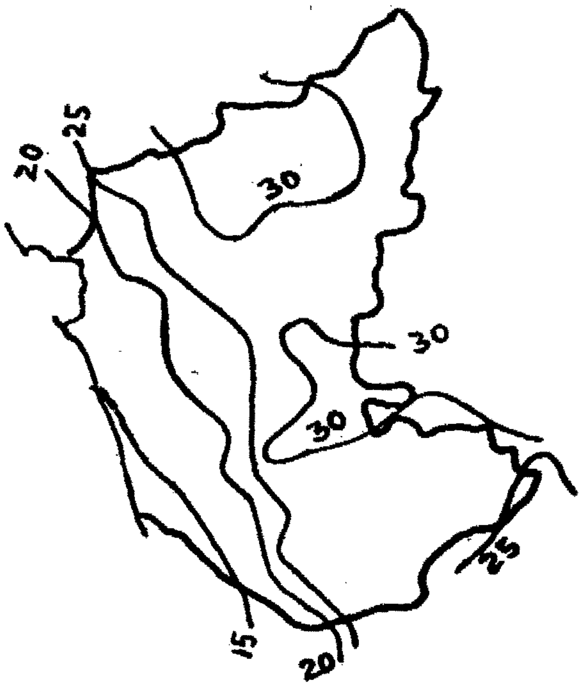
XIII

Rainfall Cm.



Coefficient of Variation of Rainfall (percent)

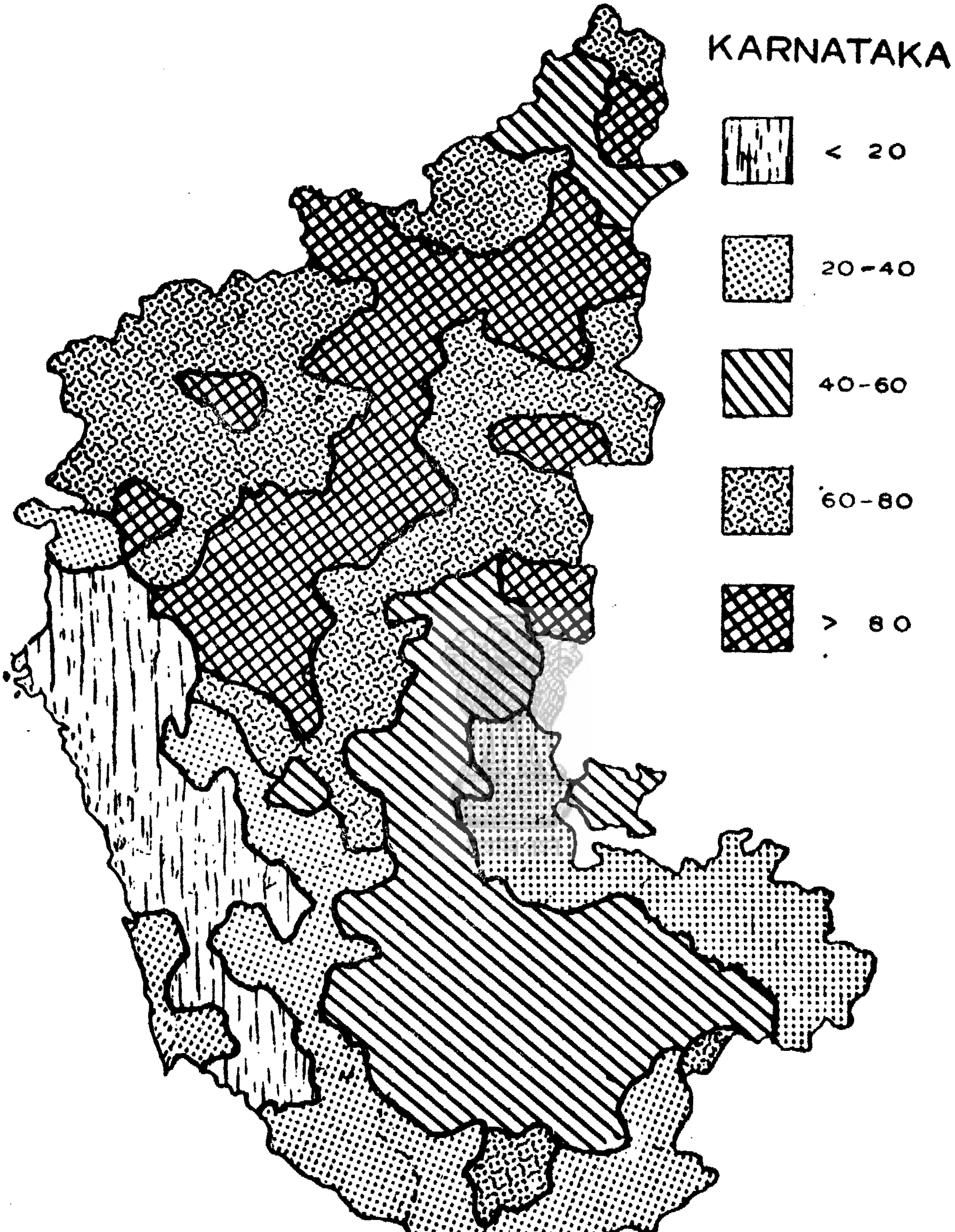
XIV



Annexure 2

Maps XIII-XIV: Rainfall and Coefficient of Variation (CV) Annual

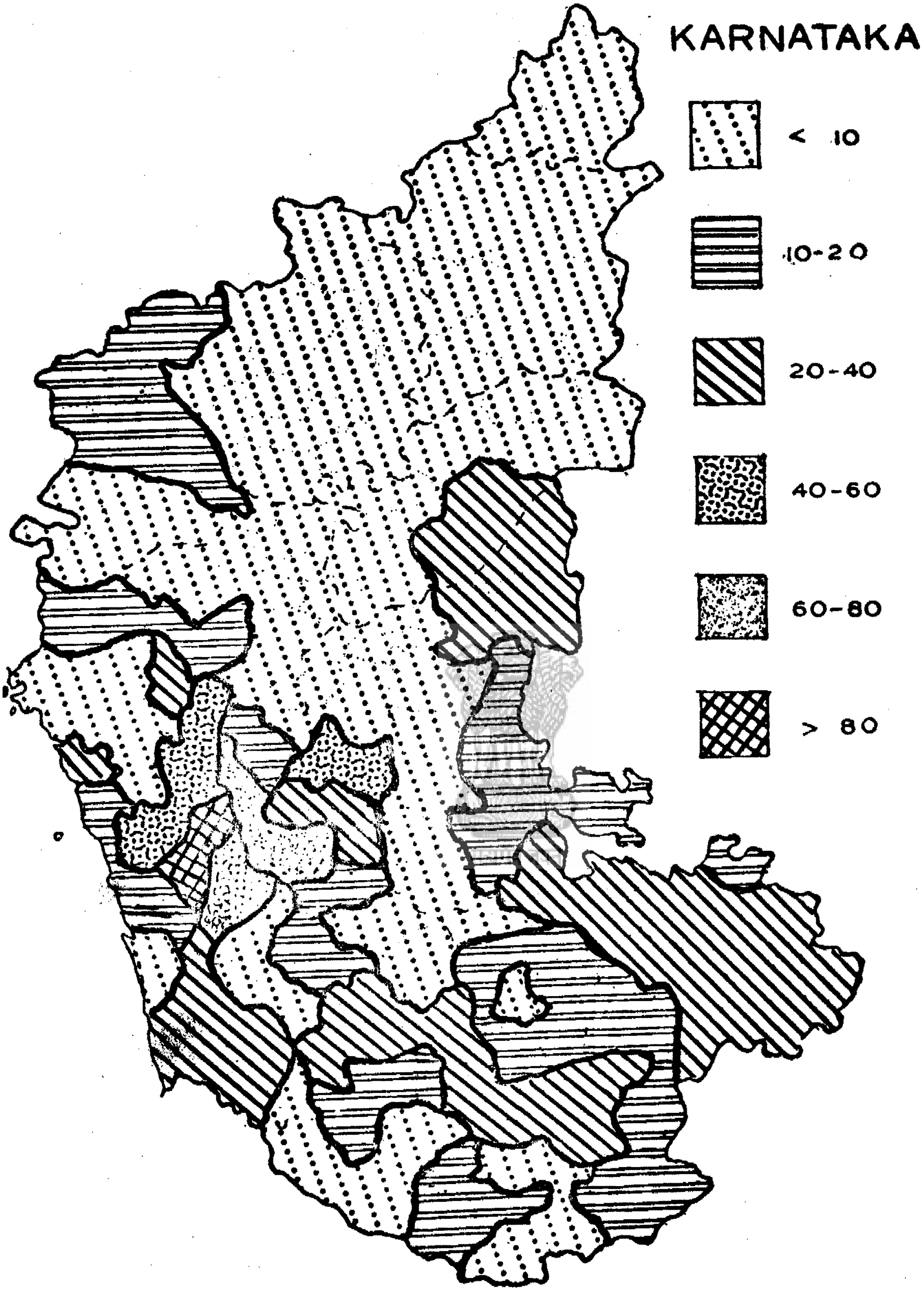
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.



Annexure 2

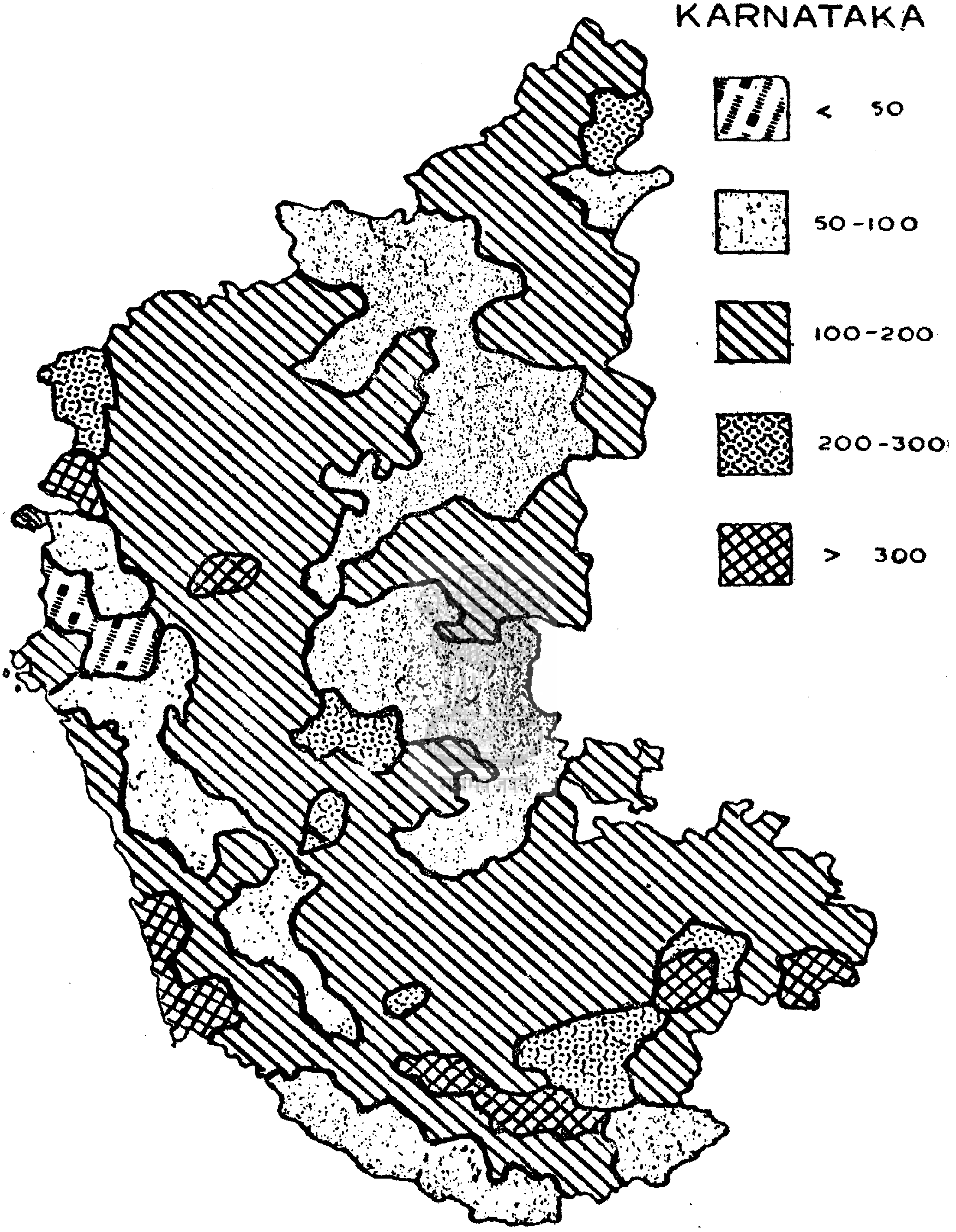
Map XV - Net Sown Area as per cent of Geographical Area

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.



Annexure 2

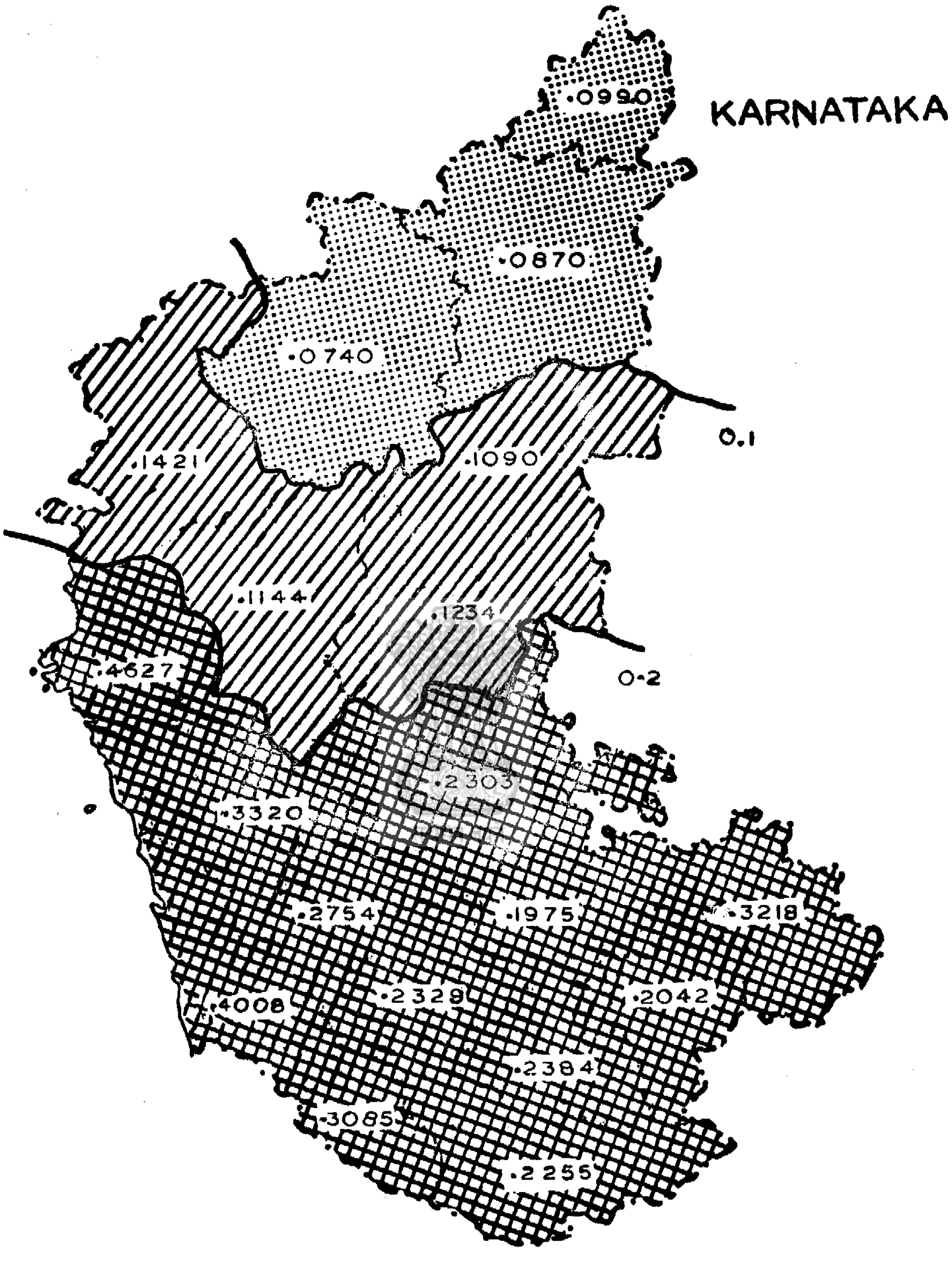
Map XVI - Irrigated Area as per cent of Gross Cropped Area
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.



Annexure 2

Map XVII - Density of Population (persons per sq.km)

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.



Annexure 2

Map XVIII - Total Power Available for Cultural Operations

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

Annexure 3

Land Use and Population Statistics of Taluks according to State Rainfall Zones

Karnataka

area = '000 ha
( ) = per cent of geographical area

district/taluk [illegible]	Population total	 per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
			Rainfall Zone - I..............Rainfall Pattern E4(C1D3)D1E3						
Bijapur									
Bijapur	306,106	115	1 (0.3)	20 (8)	4 (1)	4 (2)	0.3 (0.1)	27 (10)	210 (79)
Bagevadi	185,695	94	1 (1)	9 (5)	0.2 (0.1)	1 (1)	– (–)	5 (3)	181 (90)
Jamkhandi	206,932	177	11 (10)	6 (5)	1 (1)	1 (1)	0.3 (0.3)	6 (5)	91 (78)
Bilgi	82,601	106	12 (15)	6 (8)	– (–)	0.1 (0.1)	– (–)	1 (1)	59 (76)
Mudhol	122,503	128	5 (6)	5 (5)	– (–)	1 (1)	– (–)	3 (3)	82 (85)
Indi	212,040	95	– (–)	9 (4)	1 (0.4)	6 (3)	– (–)	8 (4)	198 (89)
Sindgi	191,104	188	– (–)	9 (4)	0.3 (0.1)	2 (1)	1 (0.2)	4 (2)	202 (93)

– = nil or negligible
nac = not available for cultivation
cw = culturable waste

pp&gl = permanent pastures and other grazing lands.
mtc&g = miscellaneous tree crops and groves not included in net area sown.

Note: Land categories expressed as per cent of geographical area (reporting) are given to the nearest integer value when per cent is 0.5 or higher. Due to this approximation, the total of all the categories is generally within one per cent of hundred.
Land use statistics relates to the year 1969-70

Annexure : .3 (contd.)

area = '000 ha
( ) = per cent of geographical area

district/taluk	Population total	per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
			Rainfall Zone - I.. .....Rainfall Pattern E4(C1D3)D1E3						
Bijapur									
Muddebihal	158,995	106	– (–)	8 (5)	1 (0.4)	1 (1)	0.4 (0.3)	[illegible]	133 (89)
Hungund	186,022	137	10 (7)	7 (5)	0.3 (0.2)	1 (1)	– (–)	1 (1)	116 (86)
Bagalkot	149,491	160	12 (13)	5 (6)	0.2 (0.2)	– (–)	– (–)	3 (3)	73 (78)
Raichur									
Lingsugar 2/3W	114,082	38	3 (2)	14 (11)	1 (1)	5 (3)	– (–)	28 (22)	79 (61)
Bijapur									
Badami	184,052	139	31 (22)	12 (9)	1 (1)	– (–)	– (–)	8 (6)	87 (62)

Annexure [illegible].3 (contd.)

area = '000 ha
( ) = per cent of geographical area

district/taluk	Population total	Population per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown	f
Rainfall Zone - II..........Rainfall Pattern E4(C3D1)D1E3										
Raichur										
Raichur	209,513	133	0.4 (0.3)	4 (3)	1 (0.4)	6 (4)	7 (5)	31 (21)	102 (67)	
Deodurg	126,352	84	4 (3)	14 (9)	2 (2)	8 (5)	- (-)	22 (1[illegible])	101 (67)	
Manvi	156,846	83	2 (1)	4 (3)	2 (1)	6 (3)	- (-)	13 (7)	151 (85)	
Gulbarga										
Shorapur	175,607	94	5 (3)	19 (10)	3 (2)	9 (5)	2 (1)	14 (7)	135 (72)	
Shahapur	159,347	109	5 (3)	7 (5)	2 (1)	3 (2)	0.2 (0.1)	9 (6)	121 (83)	
Raichur										
Lingsugar 1/3E	57,041	68	1 (2)	7 (11)	1 (1)	2 (3)	- (-)	14 (22)	40 (61)	
Gulbarga										
Yadgir	196,259	115	24 (14)	19 (11)	2 (1)	7 (4)	- (-)	6 (4)	113 (66)	

Annexure - 3 (contd.)

area = '000 ha
( ) = per cent of geographical area

district/taluk	Population total	per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
			Rainfall Zone - III........Rainfall Pattern E4(C4)D1E3						
Gulbarga									
Aland	197,203	114	2 (1)	7 (4)	4 (2)	5 (3)	- (-)	17 (10)	139 (80)
Gulbarga	305,722	177	3 (2)	18 (11)	2 (1)	7 (4)	- (-)	11 (6)	132 (76)
Afzalpur	111,779	85	- (-)	10 (8)	1 (1)	1 (1)	- (-)	14 (11)	103 (79)
Jewargi	136,358	76	- (-)	9 (5)	0.2 (0.1)	7 (4)	- (-)	13 (7)	151 (84)
Sedam	107,316	111	2 (2)	9 (9)	0.4 (1)	5 (5)	- (-)	12 (12)	69 (71)
Chitapur	217,049	121	0.2 (0.1)	14 (8)	3 (1)	5 (3)	0.1 (0.1)	13 (7)	145 (81)
Chincholi	132,580	85	30 (19)	16 (10)	4 (3)	9 (6)	0.4 (0.2)	3 (2)	94 (60)

Annexure IV.3 (contd.)

area '000 ha
( ) per cent of geographical area

district/taluk	Population total	Population per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
Rainfall Zone - IV..........Rainfall Pattern - E4(B1C3)D1E3									
Bidar									
Bidar	190,849	206	1 (1)	4 (5)	2 (2)	1 (1)	0.4 (0.4)	4 (5)	80 (86)
Basavakalayan	174,700	146	1 (1)	13 (11)	- (-)	14 (12)	- (-)	27 (22)	65 (54)
Humnabad	158,386	160	7 (7)	19 (19)	5 (6)	5 (5)	4 (4)	23 (23)	35 (36)
Bhalki	156,443	140	1 (1)	6 (5)	3 (2)	4 (3)	17 (15)	13 (12)	68 (62)
Aurad	143,681	117	- (-)	5 (4)	1 (1)	2 (1)	3 (3)	26 (21)	86 (70)

Annexure .3 (contd.)

area = '000 ha
( ) = per cent of geographical area

rict/taluk	Population total	Population per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
Rainfall Zone – V.......Rainfall Pattern D1E3(D2E2)C1D1E2									
Chitradurga									
Hiriyur	158,776	93	12 (7)	8 (4)	6 (3)	28 (17)	7 (4)	63 (37)	47 (28)
Challakere	182,632	89	7 (3)	22 (11)	16 (8)	22 (11)	– (–)	61 (30)	78 (37)

area = '000 ha
( ) = per cent of geographical area

District/taluk	Population total	Population per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
Rainfall Zone – VI.......Rainfall Pattern D1E3(C1D3)D1E3									
Bellary									
Bellary	265,294	157	3 (2)	16 (9)	1 (1)	0.2 (0.1)	0.2 (0.1)	7 (4)	141 (84)
Siruguppa	110,103	106	0.3 (0.3)	11 (11)	8 (8)	0.1 (0.1)	0.3 (0.3)	8 (8)	76 (72)
Raichur									
Sindhanur	139,978	88	1 (1)	9 (6)	1 (1)	5 (3)	– (–)	23 (14)	121 (75)
Dharwar									
Nargund	54,434	125	0.1 (0.2)	2 (5)	– (–)	– 0 (–)	– (–)	0.4 (1)	41 (94)
Belgaum									
Saundatti	214,508	136	13 (8)	11 (7)	3 (2)	4 (2)	– (–)	1 (1)	126 (80)

Annexure 3(con

area '000 ha
() per cent of
geographical area

district/taluk	Population		forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
	total	per sq km							
	Rainfall Zone - VI (contd)			Rainfall Pattern	D1E3(C1D3)D1E3				
Bellary									
Sandur	92,904	75	25 (27)	24 (26)	5 (5)	- (-)	- (-)	1 (1)	39 (41)
Kuldligi	157,456	86	37 (20)	24 (13)	9 (5)	2 (1)	3 (2)	25 (14)	83 (45)
Chitradurga									
Molkalmuru ½N	36,636	99	7 (21)	3 (7)	0.3 (1)	7 (18)	0.1 (0.[illegible])	1 ([illegible])	13 (49)
Bellary									
Harparibhalli	145,714	102	22 (16)	17 (12)	8 (5)	2 (1)	1 (1)	4 (3)	89 (62)
Belgaum									
Ramdurg	123,587	110	14 (12)	9 (7)	1 (1)	2 (2)	- (-)	4 (3)	92 (75)
Gokak	272,803	177	22 (14)	12 (8)	1 (1)	1 (1)	- (-)	5 (3)	112 (73)
Athani	278,234	139	1 (0.4)	12 (6)	4 (2)	5 (3)	0.1 (0.1)	17 (8)	161 (81)

Annexure 14.3 (contd.)

area = '000 ha
( ) = per cent of
geographical area

district/taluk	Population		forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
	total	per sq km							
Rainfall Zone - VI (contd.).........Rainfall Pattern D1E3(C1D3)D1E3									
Belgaum									
Raibag	155,699	162	1 (2)	6 (7)	4 (4)	3 (3)	0.4 (0.4)	11 (11)	70 (73)
Dharwar									
Navalgund	111,614	103	- (-)	3 (3)	- (-)	- (-)	- (-)	1 (1)	104 (96)
Belgaum									
Chikodi	364,075	227	0.1 (0.1)	12 (10)	2 (2)	3 (3)	0.2 (0.1)	8 (6)	100 (79)
Dharwar									
Gadag	206,908	189	3 (3)	2 (2)	0.3 (0.2)	3 (2)	0.2 (0.2)	4 (4)	98 (89)
Ron	171,037	133	0.3 (0.2)	7 (6)	0.4 (0.3)	0.4 (0.3)	- (-)	3 (2)	118 (92)
Raichur									
Koppal	163,506	119	11 (8)	21 (15)	2 (1)	2 (1)	4 (3)	5 (4)	93 (68)

Annexure 3 (contd.)

area ( ) '000 ha per cent of geographical area

district/taluk	Population		forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
	total	per sq km							
Rainfall Zone -VI (contd.)..... Rainfall Pattern D1E3(C1D3)D1[illegible]									
Bellary									
Mallpuram	35,933	69	2 (5)	15 (33)	3 (7)	0.1 (0.3)	- (-)	4 (9)	21 (40)
Hadagalli	127,452	85	6 (5)	15 (13)	3 (2)	3 (2)	- (-)	9 (7)	89 (71)
Dharwar									
Mundargi	73,207	83	16 (18)	3 (3)	- (-)	2 (2)	- (-)	4 (5)	64 (72)
Raichur									
Kushtagi	128,690	94	5 (3)	10 (8)	1 (1)	5 (3)	- (-)	1 (1)	115 (84)
Yelburga	140,918	95	0.2 (0.1)	4 (3)	1 (1)	2 (1)	- (-)	18 (12)	124 (83)
Bellary									
Hospet	187,830	211	23 (26)	11 (12)	3 (4)	3 (3)	1 (1)	2 (2)	

Annexure .3 (contd.)

area = '000 ha
( ) = per cent of geographical area

district/taluk	Population		forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
	total	per sq km							
Rainfall Zone – VI (contd.) .... Rainfall Pattern D1E3(C1D3) D1E3									
Raichur									
Gangawathi	178,814	135	0.4 (0.3)	18 (14)	4 (3)	7 (5)	– (–)	8 (6)	94

Annexure : 3 (contd.)

area = '000 ha
( ) =per cent of geographical area

district/taluk	Population total	Population per sq km	forests	nac	cw	pp&gl	misc	fallow lands	net area sown
		Rainfall Zone - VII			.... Rainfall Pattern D1E3(C1D3)C1D1E2				
Chitradurga									
Davanagere	276,747	289	2 (2)	8 (8)	1 (1)	5 (6)	- (-)	35 (37)	44 (46)
Harihar	124,112	256	1 (3)	4 (8)	- (-)	2 (5)	- (-)	8 (17)	32 (67)
Shimoga									
Honnali ½E	68,381	153	5 (11)	6 (12)	0.4 (1)	7 (15)	- (-)	3 (5)	25 (56)
Channagiri ½E	87,989	146	9 (15)	5 (8)	1 (2)	7 (11)	- (-)	- (-)	39 (64)
Chitradurga									
Molkalmuru ½ S	36,636	99	7 (21)	3 (7)	0.3 (1)	6.7 (18)	0.1 (-)	1 (4)	18 (49)
Jaglur	97,340	101	13 (14)	5 (5)	0.3 (0.3)	10 (10)	3 (3)	17 (18)	48 (50)
Chitradurga	209,915	153	12 (9)	13 (9)	2 (1)	19 (14)	2 (2)	15 (11)	74 (54)

Annexure 3 (contd.)

area = '000 ha
( ) = per cent of geographical area

district/taluk	Population total	Population per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
Rainfall Zone - VII (contd.) .... Rainfall Pattern D1E3(C1D3)C1D1E2									
Kolar									
Kolar	135,136	238	5 (7)	8 (12)	1 (1)	16 (24)	1 (1)	13 (19)	24 (36)
Malur	117,309	182	2 (4)	5 (10)	0.4 (1)	10 (20)	2 (4)	1 (2)	30 (39)
Bangalore									
Hoskote	153,741	220	2 (3)	4 (6)	- (-)	6 (9)	5 (8)	9 (14)	40 (60)
Tumkur									
C.N.Hally	144,396	128	8 (7)	14 (12)	20 (18)	6 (5)	3 (2)	12 (10)	51 (45)
Kortagere ½N	52,305	148	2 (5)	5 (13)	1 (4)	6 (17)	0.1 (0.2)	4 (13)	17 (48)
Madhugiri	182,139	152	3 (3)	1 (1)	18 (16)	18 (16)	0.4 (0.4)	27 (24)	44 (40)

Annexure 3 (contd.)

area = '000 ha
( ) = per cent of geographical area

District/taluk	Population total	Population per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
Rainfall Zone - VII (contd.)...............Rainfall Pattern D1E3(C1D3)C1D1E2									
Kolar									
Bangarpet	273,272	317	3 (4)	14 (20)	1 (1)	14 (20)	1 (2)	11 (16)	28 (39)
Srinivaspur	114,781	132	9 (11)	12 (15)	1 (1)	28 (34)	2 (2)	5 (6)	25 (31)
Mulbagal	136,065	165	2 (3)	14 (19)	1 (2)	20 (27)	2 (3)	6 (8)	29 (33)
Chintamani	156,415	180	2 (2)	9 (11)	1 (1)	34 (41)	1 (2)	1 (1)	35 (42)
Bagepalli	101,877	108	18 (20)	14 (16)	2 (3)	19 (21)		5 (6)	31 (34)
Chikmagalur									
Kadur	187,230	138	9 (8)	16 (12)	8 (6)	15 (11)	4 (3)	6 (4)	75 (56)
Tarikere	149,260	120	43 (36)	8 (7)	1 (1)	10 (8)	1 (1)	14 (12)	43 (35)

Annexure .3 (contd.)

area = '000 ha
( ) = per cent of
geographical area

district/taluk	Population total	per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown	-
Rainfall Zone - VII (contd.)........Rainfall Pattern - D1E3(C1D3)C1D1E2										
Chitradurga										
Holalkere	134,863	123	9 (8)	11 (10)	1 (1)	28 (25)	2 (1)	10 (9)	50 (45)	
Hosadurga	139,799	98	13 (9)	22 (16)	28 (20)	16 (11)	- (-)	4 (3)	58 (41)	
Chikmagalur										
Chikmaglur 1/2 E	87,632	107	24 (30)	7 (9)	4 (4)	13 (16)	3 (4)	5 (6)	25 (31)	
Tumkur										
Paragada	144,673	106	6 (4)	12 (9)	6 (4)	13 (10)	0.4 (0.3)	38 (28)	60 (45)	
Sira	175,430	113	5 (3)	29 (19)	10 (6)	24 (16)	3 (2)	41 (27)	42 (27)	
Dharwar										
Ranebennur	166,013	183	13 (14)	3 (3)	0.4 (0.4)	3 (3)	1 (1)	3 (4)	68 (75)	

Annexure 3 (contd.)

area= '000 ha
( ) = per cent of
geographical area

district/taluk	Population total	Population per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
	Rainfall Zone VIII...............				Rainfall Pattern - D1E3(C2D2)C1E3				
Dharwar									
Shiggaon	96,107	163	10 (17)	2 (3)	1 (1)	5 (8)	- (-)	1 (2)	41 (69)
Belgaum									
Bailhongal	182,537	163	8 (7)	6 (6)	1 (1)	2 (2)	0.2 (0.2)	- (-)	5 (84)
Dharwar									
Dharwar	127,172	114	14 (12)	4 (3)	3 (3)	6 (6)	1 (1)	6 (6)	78 (69)
Hubli	455,144	618	2 (3)	0.3 (1)	0.1 (0.1)	2 (3)	- (-)	3 (4)	66 (89)
Kundagol	100,812	155	- (-)	0.2	- (-)		- (-)	3 (5)	61 (95)
Haveri	140,969	136	4 (5)	6 (7)	0.3 (0.4)	2 (2)	1 (1)	2 (3)	65 (82)
Savanur	78,779	146	1 (2)	1 (2)		1 (2)	1 (2)	3 (5)	47 (87)

Annexure .3 (contd.)

area ='000 ha
( ) =per cent of
geographical area

district/taluk	Population total	Population per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
Rainfall Zone - V III (contd.)........Rainfall Pattern - D1E3(C2D2)C1E3									
Belgaum									
Hukheri	240,927	243	15 (15)	8 (8)	0.4 (0.4)	1 (1)	- (-)	6 (6)	69 (70)
Dharwar									
Shirahatti	117,136	123	10 (11)	6 (6)	0.2 (0.2)	1 (1)	- (-)	2 (2)	76 (30)

Annexure 3 (contd.)

area = '000 ha
( ) = per cent of geographical area

district/taluk	Population total	Population per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
Rainfall Zone – IX………………Rainfall Pattern D1E3(C2D3)C[illegible]									
Bangalore									
Magadi	172,514	185	3 (4)	13 (16)	– (–)	14 (17)	1 (2)	6 (7)	45 (54)
Davanhalli	130,478	219	3 (6)	7 (14)	1 (2)	12 (24)	[illegible] (5)	3 (6)	22 (43)
Dodballapur	154,636	195	5 (6)	11 (14)	5 [illegible]	11 (14)	0.4 (1)	5 (6)	40 (53)
Nelamangla	134,885	204	2 (3)	8 (13)	– (–)	7 (10)		9 (14)	40 (60)
Bangalore(N)½	862,339	3,765	0.3 (1)	6 (28)	1 (3)	2 (11)	1 (3)	1 (3)	11 (51)
Tumkur									
Tumkur	263,402	254	1 (1)	12 (12)	2 (2)	10 (10)	3 (3)	19 (18)	56 (54)
Kunigal	180,170	182	7 (8)	12 (12)	6 (6)	14 (14)	0.4 (0.3)	12 (12)	47 (48)

Annexure 3 (contd.)

area = '000 ha
( ) = per cent of geographical area

district/taluk	Population total	Population per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
Rainfall Zone - IX (contd.) ....Rainfall Pattern D1E3(C2D2)C1D1E2									
Kolar									
Chikballapur	112,092	175	20 (35)	9 (16)	1 (2)	6 (11)	0.3 (1)	2 (4)	17 (31)
Tumkur									
Gubbi	165,217	135	10 (8)	15 (12)	3 (2)	18 (15)	3 (2)	18 (15)	56 (46)
Turuvekere	125,575	165	1 (1)	6 (8)	1 (2)	15 (20)	1 (1)	9 (12)	43 (56)
Tibture ½ E	71,055	136	0.3 (1)	3 (9)	3 (9)	6 (16)	6 (15)	4 (11)	15 (39)
Kolar									
Sidalghatta	103,454	160	1 (2)	6 (10)	1 (2)	23 (40)	1 (2)	4 (7)	21 (37)
Gudibanda	32,533	50	2 (11)	4 (16)	1 (4)	5 (21)	0.2 (1)	2 (11)	8 (36)
Gouribidanur	173,712	201	5 (6)	14 (17)	3 (4)	15 (19)	1 (1)	11 (13)	33 (40)

Annexure 3 (contd.)

area = '000 ha
( ) = per cent of geographical area

district/taluk	Population total	 per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
Rainfall Zone - IX (contd.)............Rainfall Pattern D1E3(C2D2)C1D1E2									
Tumkur									
Kortagere ½S	91,069	162	2 (6)	5 (14)	1 (3)	6 (17)	- (-)	4 (12)	17 (43)

Annexure [illegible] 3. contd.

area = '000 ha
( ) = percentage of geographical area

district/taluk	population Total	population density per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
Rainfall Zone X ....Rainfall Pattern D1E3(C3D1)C1E3									
Shimoga									
Bhadravati 1/2E	101,719	295	2 (6)	3 (10)	1 (3)	12 (35)	– (–)	2 (5)	14 (41)
Channagiri 1/2W	87,989	146	9 (15)	5 (8)	1 (2)	7 (11)	– (–)	– (–)	39 (64)
Honnali 1/2N	68,381	153	4 (11)	6 (12)	0.4 (1)	7 (15)	– (–)	2 (5)	25 (56)
Dharwar									
Byadagi	76,899	176	4 (9)	3 (7)	0.3 (1)	2 (4)	– (–)	1 (2)	34 (77)
Hirekerur	142,601	177	10 (12)	2 (2)	1 (1)	3 (4)	1 (1)	5 (6)	60 (74)

Annexure 3 continued

area = '000 ha
( ) = percentage of
concessional area

District/taluk	Population		forests	nac	cw	pp&gi	mtc&g	fallow lands	net area sown
	total	density per sq km							
North Kanara		Rainfall Zone - XI ..... Rainfall Pattern D1E3(B1C2E1)C1E3							
Mundgod 1/2 E	22,232	67	26 (77)	1 (3)	0.3 (1)	0.5 (2)	- (-)	2 (5)	4 2)
Shimoga									
Bhadravati 1/2 W	101,713	295	2 (6)	4 (11)	2 (6)	12 (33)	- (-)	2 (6)	14 (38)
Shikaripur	130,467	143	17 (19)	11 (12)	9 (10)	14 (15)	- (-)	8 (8)	31 (35)
Shimoga	208,337	188	15 (14)	12 (11)	7 (6)	29 (26)	0.4 (. 1)	7 (6)	29 (26)
Dharwar									
Hangal	142,578	184	8 (11)	1 (1)	1 (1)	8 (11)	1 (1)	3 (4)	55 (71)
Kalghatgi	80,723	117	20 (29)	5 (7)	2 (3)	1 (1)	- (-)	2 (3)	40 (57)

Annexure 3 contd.

area = '000 ha

( ) = percentage of geographical area

District/taluk	population		forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
	Total	density per sq km							
Rainfall Zone - XI...............Rainfall Pattern - D1E3(B1C2E1)C1E3									
Hassan									
Belur	121,578	148	1 (1)	7 (10)	4 (6)	11 (15)	0.1 (0.2)	16 (22)	33 (46)
Alur	60,203	132	0.3 (1)	4 (9)	7 (17)	8 (19)	0.1 (0.3)	8 (19)	15 (35)
Arkalgud	127,960	189	2 (2)	7 (12)	6 (10)	6 (10)	0.2 (0.3)	6 (10)	36 (56)

Annexure 3 continued

area = '000 ha
( ) = percentage of
geographical area

district/taluk	Population total	 density per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
	Rainfall Zone - XII		Rainfall Pattern D1E3 (A1B1C2) C1E3						
Shimoga									
Sorab 2/3 E	79,436	104	16 (22)	6 (8)	4 (6)	10 (14)	1 (2)	15 (20)	20 (28)
N. Kanara									
Mundgodi 1/2 W	22,232	67	26 (77)	1 (2)	0.3 (1)	1 (2)	- (-)	2 (5)	4 (13)
Haliyal	85,107	100	61 (72)	4 (4)	1 (1)	1 (1)	0.4 (0.4)	3 (3)	16 (19)
Belgaum	429,022	414	23 (22)	8 (8)	2 (2)	2 (2)	- (-)	2 (2)	67 (64)

Annexure 3 continued

area = '000 ha
( ) = percentage of
geographical area

district/taluk	Population total	 density per sq km	forests	nac	cw	pp&gi	mtc&g	fallow lands	net area sown
North Kanara		Rainfall Zone XIII .... Rainfall Pattern D1E3(A3C1)C1E3							
Supa	35,762	19	176 (93)	3 (2)	2 (1)	0.3 (0.1)	- (-)	2 (1)	6 (3)
Yellapur	44,456	34	119 (91)	2 (1)	1 (1)	1 (1)	- (-)	1 (1)	7 (5)
Belgaum									
Khanapur	151,900	87	94 (54)	8 (4)	3 (2)	3 (2)	- (-)	15 (8)	52 (30)

Annexure 3 continued

area = '000 ha
( ) = percentage of geographical

district/taluk	Population total	density per sq km	forests	nac	cw	pp&gl	mtc&g	fallow land	net area sown
Shimoga		Rainfall Zone No. XIV .... Rainfall Pattern D1E3(A3C1)C1D1E2							
Sagar 1/2E	66,871	68	25 (26)	15 (15)	3 (4)	30 (31)	7 (8)	5 (5)	10 (11)
Thirthahally 1/3E	38,159	92	16 (39)	2 (4)	3 (8)	8 (20)	- (-)	5 (12)	7 (17)
Hosanagar 1/2 E	39,560	56	14 (20)	7 (11)	3 (4)	33 (46)	1 (1)	5 (7)	7 (11)
Sorab 1/3 W	39,718	104	8 (22)	3 (8)	2 (6)	5 (14)	1 (2)	7 (20)	10 (28)
North Kanara									
Sirsi	114,230	86	104 (78)	4 (3)	1 (1)	7 (5)	- (-)	1 (1)	16 (12)

Annexure 3 continued

area = '000 ha
( ) = percentage of geographical area

district/taluk	Population		forests	nac	cw	pp&gi	mtc&g	fallow lands	net area sown
	total	density per sq km							
North Kanara		Rainfall Zone XV .... Rainfall Pattern D1E3(A3B1)C1E3							
Karwar	104,477	143	55 (76)	4 (6)	2 (3)	- (-)	- (-)	1 (1)	10 (14)

area = '000 ha
( ) = percentage of geographical

District/taluk	Population total	Population density per sq km	forests	nac	cw	pp&gi	mtc&g	fallow lands	net area sown
North Kanara		Rainfall Zone XVI ..... Rainfall Pattern D1E3(A3B1)C1D1E2							
Ankola	67,871	74	76 (82)	4 (4)	1 (2)	- (-)	- (-)	1 (1)	10 (11)
Shimoga									
Sagar 1/2 W	65,876	68	25 (26)	15 (15)	3 (4)	30 (31)	7 (8)	5 (5)	10 (11)
Hosanagar 1/2 W	39,560	56	14 (21)	7 (10)	3 (4)	33 (47)	1 (1)	5 (7)	7 (10)
Tirthahally 2/3 W	76,318	92	32 (37)	3 (4)	7 (8)	17 (21)	- (-)	9 (11)	14 (17)
North Kanara									
Siddapur	73,802	86	68 (80)	2 (2)	1 (1)	4 (4)	- (-)	1 (2)	10 (11)
~~Chikmagalur~~									
Koppa	67,566	116	5 (9)	11 (20)	1 (2)	22 (38)	- (-)	3 (6)	14 (25)
Sringeri	27,632	62	16 (36)	3 (8)	9 20)	9 (20)	- (-)	2 (5)	5 (11)
Mudigere	86,567	74	22 (19)	5 (5)	4 (3)	49 (42)	0.1 (-)	7 (6)	29 (25)

Annexure 3 continued

area = '000 ha
( ) = percentage of geographical

district/taluk	Population total	Population density per sq km	forests	nac	cw	pp&gi	mtc&g	fallow lands	net area sown
North Kanara	Rainfall Zone XVII ....Rainfall Pattern D1E3(A4) C1D1E2								
Bhatkal	71,656	205	25 (73)	1 (4)	1 (2)	1 (3)	1 (3)	0.2 (0.4)	5 (15)
Kumta	100,743	173	40 (68)	5 (9)	1 (2)	3 (5)	- (-)	0.4 (1)	9 (15)
Honavar	106,537	141	58 (77)	4 (5)	2 (2)	1 (1)	1 (2)	1 (1)	9 (12)

area = '000 ha
( ) = percentage of geographical

Rainfall Pattern - D2E2 (A2B1C1)C1D1E2

District/taluk	Population total	Population density per sq km	forests	nac	cw	pp&gi	mtc&g	fallow lands	net area sown
Chikmagalur	Rainfall Zone XVIII ..... Rainfall Pattern D2E2 (A2B1C1) C1D1E2								
North Rajapura	43,077	53	31 (38)	9 (12)	2 (3)	26 (32)	- (-)	3 (4)	9 (11)

area = '000 ha
( ) = percentage of geographical area

district/taluk	Population total	Population density per sq km	forests	nac	cw	pp&gi	mtc&g	fallow lands	net area sown
Mandya	Rainfall Zone XIX ..... Rainfall Pattern C1E1(C1D1E2)C1D1E2								
Maddur	197,091	319	- (-)	16 (26)	5 (8)	3 (5)	- (-)	2 (3)	36 (58)
Mandya	263,311	368	2 (2)	10 (15)	3 (4)	10 (15)	0.2 (0.2)	4 (5)	41 (59)
South Patna	105,517	295	1 (2)	5 (14)	1 (2)	5 (14)	0.2 (1)	0.1 (0.4)	24 (67)
Nagmangla	130,789	232	2 (2)	9 (10)	30 (31)	1 (1)	1 (1)	11 (12)	41 (43)
Pandayapura	113,789	216	2 (4)	7 (13)	1 (2)	10 (19)	0.1 (0.2)	0.2 (0.3)	32 (62)
Malavalli	189,645	234	12 (15)	9 (12)	3 (4)	11 (14)	0.1 (0.1)	2 (2)	43 (53)

area = '000 ha
( ) = percentage of geographical area

District/taluk	Population total	Population density per sq km	forests	nac	cw	pp&gi	mtc&g	fallow lands	net area sown
Rainfall Zone XX ..... Rainfall Pattern C1E3 (C2D2) C1D1E2									
Bangalore									
Ramanagram	136,221	216	8 (15)	2 (4)	1 (2)	13 (23)	- (-)	2 (4)	28 (52)
Bangalore (S)	235,850	382	1 (2)	12 (21)	3 (5)	4 (7)	2 (3)	4 (7)	33 (65)
Kanakpura	219,821	140	52 (34)	21 (13)	1 (1)	20 (13)	0.1 (0.1)	4 (3)	55 (36)
Anekal	129,600	243	0.3 (1)	5 (11)	1 (3)	8 (17)	0.4 (1)	1 (3)	30 (64)
Bangalore (N) ½ S	862,389	841	0.3 (1)	6 (28)	1 (3)	2 (11)	1 (3)	1 (3)	11 (51)
C. Patna	172,990	318	1 (2)	7 (14)	1 (3)	9 (18)	0.2 (0.3)	1 (2)	29 (61)

Annexure 3 continued

area = '000 ha

( ) =percentage of geographical area

District/taluk	Population Total	Population Density per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
South Kanara		Rainfall Zone XXI ..... Rainfall Pattern C1E3(M)C1D1E2							
Bantwal	226,787	325	6 (9)	21 (29)	13 (18)	2 (3)	3 (4)	3 (4)	24 (33)
Mangalore	490,566	886	- (-)	20 (37)	4 (7)	1 (2)	2 (4)	4 (7)	24 (43)
Udipi	384,909	416	7 (7)	15 (16)	8 (9)	6 (6)	13 (14)	7 (7)	37 (39)
Coondapur	242,810	156	64 (41)	21 (14)	9 (6)	5 (3)	20 (13)	7 (4)	29 (19)

Annexure 3 continued

area = '000ha
( ) =percentage of geographical area

district/taluk	population Total	 Density per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
Rainfall Zone XVII ...... Rainfall Pattern C1E3 ([illegible]) B1C1E2									
South Kanara Karkal	212,496	155	31 (22)	5 (4)	23 (17)	3 (2)	25 (19)	21 (15)	29 (21)
Belthangady	137,535	99	60 (42)	26 (18)	13 (9)	5 (3)	18 13	3 (2)	19 (13)
Puthur	156,266	170	30 (30)	30 (32)	3 (3)	5 (5)	8 (8)	6 (6)	16 (16)
Sullia	87,946	106	48 (58)	5 (6)	4 (5)	7 (8)	5 (6)	3 (3)	11 (14)

Annexure 3 continued

area = '000 ha
( ) = percentage of geographical area

district/taluk	Population total	Population density per sq km	forests	nac	cw	pp&gi	mtc&g	fallow lands	net area sown
MYSORE	Rainfall Zone XXIII ..... Rainfall Pattern $C_1D_1E_2(D_2E_2)C_1D_1E_2$								
Gundlupet	139,152	98	48 (34)	11 (8)	6 (3)	14 (10)	5 (3)	7 (5)	52 (37)
Chamarajanagar	227,576	185	27 (22)	12 (10)	5 (3)	18 (15)	3 (2)	10 (8)	49 (40)

area = '000 ha
( ) = percentage of geographical area

district/taluk	Population		forests	nac	cw	pp&gi	mtc&g	fallow lands	net area sown
	total	density per sq km							
	Rainfall Zone XXIV .... Rainfall Pattern C1D1E2(C1D3)C1D1E2								
Mysore									
K.R.Nagar	158,845	256	- (-)	11 (18)	3 (6)	9 (15)	0.1 (0.2)	3 (5)	35 (56)
Nanjangud	228,388	232	4 (4)	15 (15)	2 (2)	10 (11)	- (-)	6 (6)	62 (63)
T.M.Pura	182,340	311	0.1 (0.3)	6 (10)	1 (1)	4 (6)	0.2 (0.4)	3 (5)	45 (72)
Yelandur	48,803	184	9 (34)	4 (17)	0.1 (0.2)	2 (9)	- (-)	2 (9)	8 (31)
Mysore	493,800	604	- (-)	12 (15)	2 (2)	12 (15)	1 (1)	5 (6)	50 (61)
H.D.Kote	145,068	75	28 (15)	30 (16)	12 (6)	69 (36)	5 (2)	12 (6)	37 (19)
Hunsur	136,914	139	9 (9)	19 (19)	4 (4)	23 (23)	0.4 (0.4)	7 (7)	37 (38)
Periyapatna	115,381	162	6 (8)	6 (8)	9 (14)	14 (20)	2 (2)	6 (8)	29 (40)
Mandya									
K.R.Pet	154,232	168	5 (5)	9 (10)	9 (10)	17 (20)	0.2 (0.2)	7 (8)	43 (47)

area = '000 ha
( ) = percentage of geographical area

district/taluk	Population total	Population density per sq km	forests	nac	cw	pp&gi	metc&g	fallow lands	net area sown
HASSAN	Rainfall Zone XXIV ...... Rainfall Pattern C1D1E2(C1D3) C1D1E2								
Holenarsipur	107,240	173	1 (1)	12 (22)	3 (5)	7 (12)	0.1 (0.2)	12 (21)	22 (39)
Hassan	214,707	240	0.4 (1)	14 (15)	2 (2)	15 (16)	0.3 (0.4)	16 (17)	36 (39)
MYSORE									
Kollegal	200,971	72	193 (70)	16 (5)	2 (1)	0.4 (0.1)	- (-)	12 (4)	55 (20)
HASSAN									
Arsikere	208,961	168	9 (8)	14 (11)	3 (3)	21 (17)	3 (2)	10 (8)	63 (51)
C. Patna	170,546	163	0.2 (0.2)	16 (15)	4 (4)	6 (6)	0.4 (0.4)	15 (14)	63 (61)
TUMKUR									
Tiptur 1/2 W	71,055	186	0.3 (1)	3 (9)	3 (9)	6 (16)	(15)	4 (11)	15 (39)

Annexure 3 continued

area = '000 ha
( ) = percentage of geographical area

district/taluk	Population Total	Population Density per sq km	forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
		Rainfall Zone XXV	Rainfall Pattern C1D1E2(A3C1)C1D1E2						
Coorg									
Virajpet ½ E	71,492	86	34 (40)	6 (7)	7 (9)	6 (7)	7 (9)	- (-)	23 (28)
Somvarpet	139,070	139	21 (21)	23 (23)	5 (5)	9 (9)	3 (3)	- (-)	39 (39)
Hassan									
Sakleshpur	91,175	83	11 (10)	5 (5)	5 (5)	25 (24)	2 (2)	17 (16)	40 (38)
Chikmagalur									
Chikmagalur ½ W	87,652	107	24 (30)	7 (9)	3 (4)	13 (16)	3 (4)	4 (6)	25 (3[illegible])

Annexure 3 (contd.)

area = '000 ha

( ) = percentage of geographical area

district/taluk	population		forests	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
	Total	Density per sq km							
	Rainfall Zone XXVI......Rainfall Pattern C1D1E2(A4)C1D1E2								
Coorg									
Virajpet ½ W	71,492	86	34 (40)	6 (7)	7 (9)	6 (7)	7 (9)	- (-)	23 (28)
Mercara	96,237	65	48 (33)	17 (12)	20 (14)	4 (3)	22 (15)	2 (1)	32 (22)

Livestock Statistics (1966) of Taluks arranged according to State Rainfall Zones

unit = number in thousands
( ) = % of total livestocks

Rainfall Zone I

Rainfall Pattern - $E_4(C_1D_3)D_1E_3$

district underlined taluk	cattle male	cattle female	cattle young stock	buffaloes male	buffaloes female	buffaloes young stock	sheep	goats	horses and ponies	mules	donkeys	camels	pigs	total lives stock
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
BIJAPUR														
Bijapur	27 (15)	23 (13)	21 (12)	1 (0.3)	11 (6)	8 (5)	44 (24)	41 (23)	1 (1)	- (-)	- (-)	- (-)	2 (1)	179
Bagevadi	26 (13)	14 (10)	16 (12)	0.4 (0.3)	12 (9)	9 (7)	28 (28)	31 (23)	1 (0.4)	- (-)	0.4 (0.3)	- (-)	1 (.4)	178
Jamkhandi	14 (14)	11 (10)	12 (12)	0.2 (0.2)	10 (10)	9 (9)	21 (21)	22 (22)	0.4 (0.4)	- (-)	1 (1)	- (-)	1 (1)	101
Bilji	12 (15)	8 (10)	9 (11)	0.1 (0.1)	7 (9)	5 (7)	18 (23)	20 (25)	0.2 (0.2)	- (-)	- (-)	- (-)	0.1 (.1)	80
Mudhol	13 (14)	17 (19)	8 (9)	0.2 (0.2)	8 (9)	6 (7)	19 (21)	17 (19)	0.2 (0.3)	- (-)	0.1 (0.1)	- (-)	1 (1)	88
Indi	26 (15)	24 (13)	21 (12)	1 (0.4)	12 (7)	10 (6)	30 (17)	50 (28)	1 (1)	- (-)	0.1 (0.1)	- (-)	3 (2)	179
Sindgi	28 (21)	15 (11)	18 (13)	1 (0.4)	11 (8)	9 (7)	22 (16)	31 (23)	1 (1)	- (-)	0.4 (0.3)	- (-)	1 (1)	137

Annexure 4 (contd.)

Rainfall Zone - I

unit = number in thousands
( ) = % of total livestocks
Rainfall Pattern- $E_4(C_1D_3)E_4$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
BIJAPUR														
Muddebihal	23 (19)	12 (10)	13 (11)	0.3 (0.3)	12 (10)	9 (8)	23 (19)	25 (21)	1 (1)	- (-)	0.2 (0.2)	- (-)	1 (1)	119
Hungund	23 (15)	13 (9)	13 (9)	0.3 (0.2)	14 (9)	10 (7)	35 (24)	39 (26)	0.4 (0.3)	- (-)	0.3 (0.2)	- (-)	1 (1)	148
Bagalkot	18 (17)	10 (10)	11 (10)	0.1 (0.1)	10 (10)	7 (6)	26 (25)	23 (21)	0.3 (0.2)	- (-)	- (-)	- (-)	1 (1)	106
RAICHUR														
Lingsugur 2/3W	20 (21)	13 (14)	11 (11)	0.4 (0.4)	7 (7)	6 (6)	22 (23)	16 (16)	0.4 (1)	- (-)	- (-)	- (-)	- (-)	100
BIJAPUR														
Badami	25 (15)	17 (10)	17 (10)	0.4 (0.2)	16 (10)	11 (7)	41 (24)	39 (23)	0.3 (0.2)	- (-)	0.1 (0.1)	- (-)	1 (1)	168

Rainfall Zone II Annexure 4 (contd) Rainfall Pattern- $E_4(C_3D_1)D_1E_3$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
RAICHUR														
Raichur	26 (23)	12 (11)	6 (6)	1 (1)	8 (7)	3 (3)	38 (34)	16 (14)	0.2 (0.1)	- (-)	0.1 (0.1)	- (-)	1 (1)	111
Deodurg	25 (23)	19 (17)	10 (9)	0.4 (0.4)	7 (6)	4 (3)	28 (25)	17 (15)	2 (1)	- (-)	0.4 (0.4)	- (-)	- (-)	113
Manvi	26 (24)	13 (12)	10 (10)	0.6 (0.5)	9 (8)	5 (5)	28 (26)	15 (14)	1 (.5)	- (-)	0.2 (0.2)	- (-)	1 (1)	108
GULBARGA														
Shorapur	7 (5)	22 (14)	24 (16)	2 (1)	12 (8)	9 (6)	50 (33)	25 (16)	1 (.4)	- (-)	0.4 (0.2)	- (-)	0.4 (0.2)	153
Shahapur	31 (21)	22 (15)	19 (13)	2 (1)	11 (7)	7 (5)	33 (22)	20 (14)	2 (1)	- (-)	1 (0.4)	- (-)	1 (0.4)	147
RAICHUR														
Lingsugur 1/3E	10 (20)	7 (14)	6 (12)	0.2 (0.4)	4 (8)	3 (6)	12 (24)	8 (16)	0.1 (0.2)	- (-)	- (-)	- (-)	- (-)	49
GULBARGA														
Yadgir	33 (22)	25 (14)	16 (9)	1 (0.4)	12 (7)	6 (3)	40 (23)	36 (20)	1 (1)	- (-)	1 (1)	- (-)	1 (0.3)	180

Annexure 4 (contd)

unit = number '000
( ) = % of total livestock

Rainfall Zone III

Rainfall Pattern - $E_4(C_4)D_1E_3$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
GULBARGA														
Aland	30 (23)	22 (17)	22 (17)	1 (1)	12 (9)	8 (6)	NA	NA	1 (1)	- (-)	0.3 (0.3)	- (-)	1 (2)	131
Gulbarga	32 (24)	23 (16)	20 (15)	1 (1)	12 (9)	8 (6)	20 (15)	17 (12)	1 (0.5)	- (-)	1 (1)	- (-)	1 (1)	135
Afzalpur	20 (24)	11 (13)	10 (12)	0.1 (0.1)	6 (6)	4 (5)	17 (21)	14 (17)	0.4 (0.4)	- (-)	0.1 (0.1)	- (-)	1 (1)	84
Jevargi	24 (23)	16 (16)	12 (12)	1 (1)	7 (7)	4 (4)	24 (23)	14 (13)	1 (1)	- (-)	0.1 (0.1)	- (-)	1 (1)	104
Sedam	32 (28)	23 (20)	16 (14)	1 (1)	6 (6)	4 (4)	13 (12)	16 (14)	1 (0.4)	- (-)	1 (0.4)	- (-)	1 (0.4)	115
Chitapur	36 (25)	27 (19)	20 (14)	2 (1)	10 (7)	6 (4)	19 (13)	21 (15)	2 (1)	- (-)	0.4 (0.3)	- (-)	1 (1)	145
Chincholi	30 (27)	22 (20)	12 (10)	1 (1)	7 (6)	4 (3)	18 (16)	17 (15)	1 (1)	- (-)	0.4 (0.3)	- (-)	0.4 (0.3)	111

Annexure

( ) = % of

Rainfall Zone IV

Rainfall Pattern - $E_4(B_1C_3)D_1E_3$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15
BIDAR														
Bidar	24 (24)	19 (19)	11 (11)	2 (2)	16 (15)	6 (6)	9 (9)	11 (11)	1 (1)	- (-)	0.3 (0.3)	0.1 (0.1)	3 (3)	103
Basavakalyan (B.Kalyan)	30 (25)	24 (21)	18 (16)	1 (1)	11 (10)	6 (5)	11 (10)	12 (10)	1 (1)	- (-)	0.3 (0.2)	- (-)	2 (1)	118
Humnabad	22 (24)	16 (18)	11 (12)	1 (1)	7 (8)	5 (6)	9 (10)	14 (16)	1 (1)	- (-)	1 (1)	0.1 (0.1)	2 (3)	90
Bhalki	23 (22)	21 (20)	13 (13)	2 (2)	12 (11)	6 (6)	13 (12)	11 (11)	1 (1)	- (-)	0.2 (0.2)	0.1 (0.1)	1 (1)	103
Aurad	22 (15)	24 (16)	51 (34)	1 (1)	14 (9)	8 (5)	16 (11)	11 (7)	1 (0.4)	- (-)	1 (1)	0.3 (0.2)	1 (1)	151

Annexure 4 (contd)

unit = number '000
( ) = % of total livestock

Rainfall Zone V

Rainfal Pattern - $D_1E_3(D_2E_2)C_1D_1E_2$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
CHITRADURGA														
Hiriyur	26 (12)	13 (9)	13 (6)	2 (1)	12 (6)	7 (3)	95 (45)	35 (17)	0.4 (0.2)	- (-)	0.4 (0.3)	- (-)	2 (1)	209
Challakere	39 (13)	29 (10)	19 (7)	2 (1)	13 (5)	9 (3)	135 (46)	41 (14)	0.2 (0.1)	- (-)	1 (0.2)	- (-)	3 (1)	290

Annexure 4 (contd)

Rainfall Zone VI

Rainfall Pattern – $D_1E_3(C_1D_3)D_1E_3$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
BELLARY														
Bellary	17 (24)	10 (14)	7 (9)	0.4 (1)	6 (8)	3 (4)	13 (18)	14 (19)	0.3 (0.4)	- (-)	0.3 (0.4)	- (-)	1 (2)	73
Siruguppa	18 (22)	9 (11)	8 (10)	1 (1)	7 (8)	5 (6)	21 (26)	13 (15)	0.2 (0.3)	- (-)	0.2 (0.2)	- (-)	1 (1)	83
RAICHUR														
Sindhanur	5 (6)	8 (10)	9 (11)	0.2 (0.3)	8 (10)	10 (12)	23 (28)	18 (22)	0.3 (0.4)	- (-)	0.1 (0.1)	- (-)	0.3 (0.4)	83
DHARWAR														
Nargund	6 (17)	3 (8)	3 (8)	0.2 (1)	3 (8)	2 (6)	10 (28)	9 (24)	0.1 (0.2)	- (-)	- (-)	- (-)	- (-)	35
BELGAUM														
Saundatti	23 (17)	14 (10)	13 (10)	2 (1)	15 (11)	11 (8)	32 (24)	25 (18)	1 (0.4)	- (-)	0.3 (0.3)	- (-)	1 (1)	136
BELLARY														
Sandur	18 (21)	16 (18)	11 (12)	0.2 (0.2)	6 (7)	3 (4)	19 (21)	15 (16)	0.2 (0.2)	- (-)	0.1 (0.1)	- (-)	0.4 (0.4)	88

Annexure 4 (contd)

unit = number '000
( ) = % of total livestock

Rainfall Zone -VI contd.

Rainfall Pattern - $D_1E_3(C_1D_3)E_1E_3$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12	13.	14.	15
BELLARY														
Kudligi	35 (13)	24 (12)	13 (9)	0.3 (0.2)	15 (7)	9 (4)	66 (33)	34 (17)	- (-)	- (-)	0.4 (0.2)	- (-)	0.2 (0.1)	201
CHITRADURGA														
Malakalmuru	8 (17)	5 (11)	3 (8)	0.5 (1)	3 (6)	2 (4)	14 (31)	9 (21)	0.2 (0.4)	- (-)	0.2 (1)	- (-)	1 (0.3)	44
BELLARY														
Harpanabhalli	25 (20)	19 (15)	15 (12)	0.3 (0.2)	17 (13)	10 (8)	27 (21)	14 (11)	0.2 (0.1)	- (-)	- (-)	- (-)	0.2 (0.2)	128
BELGAUM														
Ramdurg	17 (14)	11 (9)	10 (9)	1 (1)	10 (8)	7 (6)	35 (30)	26 (22)	0.2 (0.2)	- (-)	0.2 (0.2)	- (-)	0.1 (0.1)	117
Gokak	26 (15)	13 (8)	12 (7)	2 (2)	21 (12)	13 (3)	45 (26)	35 (21)	0.4 (0.2)	- (-)	0.1 (0.1)	- (-)	2 (1)	170
Athni	23 (17)	19 (12)	19 (12)	0.4 (0.3)	19 (12)	16 (10)	24 (15)	35 (21)	0.1 (0.1)	- (-)	- (-)	- (-)	1 (1)	163
Raibag	17 (14)	9 (8)	8 (7)	1 (1)	13 (11)	10 (9)	37 (30)	24 (20)	0.4 (0.3)	- (-)	- (-)	- (-)	1 (0.4)	120

Rainfall Zone - VI contd. Rainfall Pattern - D$_1$E$_3$(C$_1$D$_3$)D$_1$E$_3$

( ) % of total livestock

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
DHARWAR														
Navalgund	15 (26)	6 (10)	6 (10)	0.4 (1)	7 (12)	5 (8)	8 (14)	10 (18)	0.4 (1)	- (-)	- (-)	- (-)	- (-)	53
BELGAUM														
Chikodi	30 (10)	9 (3)	6 (2)	2 (1)	42 (14)	21 (7)	140 (47)	46 (15)	1 (0.4)	- (-)	- (-)	- (-)	3 (1)	300
DHARWAR														
Gadag	18 (19)	8 (9)	8 (9)	0.2 (0.2)	10 (11)	6 (6)	25 (27)	17 (18)	0.2 (0.3)	- (-)	0.4 (1)	- (-)	0.4 (0.4)	93
Ron	20 (21)	10 (9)	9 (9)	0.4 (0.4)	13 (12)	3 (3)	21 (20)	22 (21)	0.3 (0.2)	- (-)	0.2 (0.2)	- (-)	0.4 (0.4)	105
RAICHUR														
Koppal	24 (24)	14 (14)	12 (12)	1 (1)	9 (9)	6 (6)	17 (18)	16 (16)	- (-)	- (-)	0.3 (0.3)	- (-)	0.3 (0.3)	99
BELLARY														
Mallapuram	6 (22)	5 (18)	3 (13)	0.1 (0.1)	2 (8)	1 (4)	7 (25)	3 (10)	- (-)	- (-)	- (-)	- (-)	- (-)	27
Hadagalli	21 (21)	14 (15)	12 (12)	0.2 (0.2)	10 (11)	6 (7)	20 (21)	12 (12)	0.1 (0.1	- (-)	0.1 (0.1)	- (-)	0.1 (0.1)	96

Annexure 4 (contd)

unit = number '000
( ) % of total livestock

Rainfall Zone VI (contd.)

Rainfal Pattern - $D_1E_3(C_1D_3)D_1E_3$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
DHARWAR														
Mundargi	13 (21)	7 (11)	7 (11)	0.1 (.2)	5 (8)	3 (5)	14 (22)	13 (21)	0.1 (0.1)	- (-)	0.4 (1)	- (-)	0.2 (0.3)	62
RAICHUR														
Kushtagi	25 (23)	15 (14)	16 (15)	0.4 (0.4)	8 (7)	6 (6)	18 (16)	19 (17)	1 (1)	- (-)	0.1 (0.1)	- (-)	0.1 (0.1)	109
Yelburga	20 (25)	10 (12)	10 (12)	0.3 (0.4)	7 (9)	5 (6)	16 (18)	13 (16)	1 (1)	- (-)	0.4 (1)	- (-)	0.2 (0.2)	82
BELLARY														
Hospet	19 (19)	13 (13)	11 (11)	0.4 (0.4)	8 (8)	5 (5)	22 (22)	20 (20)	0.4 (0.4)	- (-)	0.3 (0.3)	- (-)	1 (1)	101
RAICHUR														
Gangawathi	28 (24)	16 (14)	14 (12)	1 (1)	10 (8)	6 (5)	24 (21)	17 (14)	0.4 (0.3)	- (-)	0.1 (0.1)	- (-)	1 (1)	117

Annexure 4 (contd)

unit = number '000
( ) = % of total livestock

Rainfall Zone VII Rainfall Pattern - $D_1E_3(C_1D_3)C_1D_1E_2$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
CHITRADURGA														
Davanagere	22 (13)	22 (13)	13 (15)	0.3 (0.3)	18 (15)	10 (8)	13 (10)	16 (14)	1 (0.4)	- (-)	0.1 (0.1)	- (-)	3 (2)	121
Harihar	11 (22)	7 (14)	4 (8)	- (0.1)	9 (18)	5 (10)	7 (14)	7 (14)	0.3 (0.4)	- (-)	0.1 (0.1)	- (-)	0.1 (.2)	51
SHIMOGA														
Honnali ½ E	12 (21)	10 (18)	7 (13)	0.3 (1)	9 (16)	4 (7)	6 (10)	7 (12)	0.1 (0.1)		1 (1)	- (-)	- (-)	57
Channagiri ½E	15 (23)	13 (19)	9 (13)	0.4 (0.4)	10 (15)	5 (7)	7 (10)	8 (13)	0.2 (0.4)	- (-)	- (-)	- (-)	- (-)	66
CHITRADURGA														
Malakalmuru ½S	8 (17)	5 (11)	3 (8)	0.4 (1)	3 (6)	2 (4)	14 (31)	9 (21)	0.2 (0.4)	- (-)	0.2 (1)	- (-)	0.2 (0.3)	44
Jagalur	19 (20)	14 (15)	10 (10)	0.2 (0.2)	10 (10)	6 (6)	26 (28)	10 (10)	0.2 (0.2)	- (-)	0.2 (0.2)	- (-)	0.2 (0.2)	95
Chitradurga	31 (19)	23 (14)	15 (10)	1 (0.3)	19 (11)	11 (7)	38 (23)	24 (15)	1 (0.4)	- (-)	1 (0.3)	- (-)	1 (0.3)	164

Annexure 4 (contd)

unit = number '000
( ) - % of total livestock

Rainfall Zone - VII contd. Rainfall Pattern- $D_1E_3(C_1D_3)C_1D_1E_2$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
KOLAR														
Kolar	19 (12)	22 (14)	10 (7)	1 (0.3)	12 (8)	3 (5)	59 (33)	22 (14)	0.2 (0.1)	- (-)	1 (0.3)	- (-)	2 (1)	156
Malur	8 (8)	23 (22)	11 (10)	0.4 (0.3)	7 (7)	3 (3)	37 (35)	13 (12)	1 (1)	- (-)	0.4 (0.3)	- (-)	1 (1)	104
BANGALORE														
Hoskote	13 (9)	26 (18)	13 (9)	0.2 (0.2)	13 (9)	6 (4)	50 (34)	23 (16)	0.2 (0.1)	- (-)	1 (0.4)	- (-)	1 (0.4)	146
TUMKUR														
C.N.Halley	24 (15)	23 (15)	13 (8)	1 (0.3)	8 (5)	4 (3)	58 (37)	25 (16)	0.2 (0.1)	- (-)	0.2 (0.1)	- (-)	1 (1)	157
Koratgere½N	8 (15)	10 (18)	5 (10)	0.1 (0.2)	3 (5)	1 (3)	17 (31)	8 (16)	0.1 (0.2)	- (-)	0.2 (0.3)	- (-)	0.4 (1)	54
Madhugiri	25 (13)	18 (9)	11 (6)	2 (1)	12 (6)	6 (3)	91 (46)	28 (14)	0.2 (0.1)	- (-)	1 (1)	- (-)	3 (1)	198
KOLAR														
Bangarpet	16 (9)	33 (18)	23 (13)	0.2 (0.1)	5 (3)	3 (2)	80 (44)	21 (11)	- (-)	- (-)	- (-)	- (-)	1 (1)	182

Annexure 4 (contd)

Rainfall Zone - VII contd. Rainfall Pattern- $D_1E_3(C_1D_3)C_1D_1E_2$

unit = number '000
( ) = % of total livestock

	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
KOLAR														
Srinivaspur	19 (15)	19 (15)	11 (8)	1 (1)	7 (5)	4 (3)	33 (26)	28 (23)	0.2 (0.2)	- (-)	0.2 (0.2)	- (-)	6 (4)	128
Mulbagal	13 (12)	24 (16)	14 (9)	1 (1)	6 (4)	4 (3)	63 (42)	17 (11)	0.2 (0.1)	- (-)	0.1 (0.1)	- (-)	4 (2)	150
Chintamani	20 (13)	17 (11)	10 (6)	2 (2)	8 (6)	5 (3)	61 (40)	23 (15)	0.3 (0.2)	- (-)	1 (0.4)	- (-)	6 (4)	153
Bagepalli	20 (14)	20 (14)	12 (8)	1 (0.4)	4 (3)	2 (1)	50 (35)	30 (21)	0.4 (0.2)	- (-)	0.3 (0.3)	- (-)	3 (3)	142
CHIKMAGALUR														
Kadur	38 (20)	36 (19)	23 (12)	1 (0.3)	12 (7)	6 (3)	45 (24)	25 (14)	0.4 (0.3)	- (-)	0.3 (0.1)	- (-)	0.4 (0.2)	138
Tarikere	26 (21)	28 (22)	18 (15)	0.3 (0.2)	10 (8)	5 (4)	22 (18)	12 (10)	0.2 (0.2)	- (-)	0.4 (0.4)	- (-)	0.4 (0.3)	121

Annexure 4 (contd)

Rainfall Zone - VII contd.

unit = number '000
( ) = % of total livestock
Rainfall Pattern - $D_1E_3(C_1D_3)C_1D_1E_2$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
CHITRADURGA														
Holalkere	25 (18)	18 (13)	12 (8)	0.3 (0.2)	19 (14)	9 (7)	35 (26)	18 (14)	0.1 (0.1)	- -)	0.2 (0.2)	- (-)	0.1 (0.1)	136
Hosadurga	28 (17)	19 (11)	13 (7)	0.4 (0.2)	15 (9)	8 (5)	61 (36)	24 (14)	0.3 (0.3)	- (-)	0.1 (0.1)	- (-)	1 (1)	171
CHIKMAGALUR														
Chikmagalur ½ E	15 (26)	15 (26)	11 (19)	1 (2)	3 (5)	2 (2)	4 (7)	6 (10)	0.2 (0.2)	- (-)	0.1 (0.2)	- (-)	2 (3)	59
TUMKUR														
Pavgada	29 (13)	21 (10)	13 (6)	2 (1)	8 (4)	5 (2)	96 (43)	39 (18)	1 (0.3)	- (-)	1 (0.4)	- (-)	7 (3)	225
Sira	27 (11)	21 (9)	11 (4)	1 (1)	12 (5)	7 (3)	129 (54)	26 (11)	1 (0.2)	- (-)	1 (1)	- (-)	2 (1)	237
DHARWAR														
Ranebennur	21 (14)	11 (8)	9 (6)	0.2 (0.1)	17 (12)	8 (5)	54 (33)	21 (15)	1 (1)	- (-)	0.3 (0.2)	- (-)	.3 (.2)	143

Annexure 4 (contd)

unit = number '000
( ) - % of total livestock

ainfall Zone VIII

Rainfall Pattern - $D_1E_3(C_2D_2)C_1E_3$

	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
DHARWAR														
Shiggaon	22 (29)	13 (16)	14 (18)	1 (1)	9 (11)	6 (7)	4 (5)	9 (12)	0.4 (1)	- (-)	0.1 (0.1)	0.1 (0.1)	0.1 (0.1)	77
BELGAUM														
Bailhongal	22 (23)	11 (11)	10 (11)	3 (3)	22 (22)	13 (13)	1 (1)	8 (8)	0.4 (0.4)	- (-)	- (-)	- (-)	8 (8)	98
DHARWAR														
Dharwar	25 (27)	13 (15)	14 (16)	1 (1)	15 (17)	9 (10)	5 (5)	8 (9)	0.2 (0.3)	- (-)	- (-)	- (-)	- (-)	92
Hubli	15 (26)	7 (12)	8 (13)	0.2 (0.3)	10 (18)	6 (10)	3 (5)	8 (14)	0.3 (1)	- (-)	- (-)	- (-)	0.3 (1)	58
Kundagol	14 (29)	5 (11)	5 (11)	0.1 (0.3)	9 (18)	5 (11)	5 (11)	4 (9)	0.4 (1)	- (-)	- (-)	- (-)	- (-)	48
Haveri	23 (24)	13 (13)	11 (11)	1 (1)	13 (14)	8 (8)	18 (17)	12 (12)	0.4 (0.4)	- (-)	- (-)	- (-)	0.3 (0.4)	98
Savanur	22 (28)	13 (16)	14 (18)	1 (1)	9 (12)	6 (7)	4 (5)	9 (12)	0.4 (1)	- (-)	- (-)	- (-)	- (-)	77

Annexure 4 (contd)

unit = number '000
( ) = % of total livestock

Rainfall Zone VIII contd.

Rainfall Pattern - $D_1E_3(C_2D_2)C_1E_3$

1.	2	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
DHARWAR														
Shirahatti	17 (21)	10 (13)	10 (13)	0.2 (0.2)	9 (12)	5 (6)	15 (19)	12 (15)	0.1 (0.3)	- (-)	0.2 (0.3)	- (-)	0.1 (0.2)	79
BELGAUM														
Hukkeri	24 (15)	9 (5)	6 (4)	5 (3)	26 (16)	14 (9)	42 (26)	23 (17)	0.1 (0.1)	- (-)	- (-)	- (-)	8 (5)	162

Annexure 4 (contd)

unit = number '000
( ) - % of total livestock

Rainfall Zone IX

Rainfall Pattern - $I_1E_3(C_2L_2)C_1D_1E_2$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12	13.	14.	15.
BANGALORE														
Magadi	14 (8)	52 (30)	23 (14)	0.2 (0.1)	9 (5)	4 (3)	45 (26)	23 (13)	0.3 (0.2)	- (-)	1 (0.3)	- (-)	1 (1)	173
Davanhalli	13 (13)	14 (15)	7 (7)	1 (1)	11 (11)	5 (5)	34 (35)	11 (11)	0.2 (0.2)	- (-)	1 (1)	- (-)	1 (1)	98
Dodballapur	19 (14)	29 (20)	16 (12)	0.3 (0.2)	10 (7)	4 (3)	42 (29)	17 (12)	1 (1)	- (-)	1 (1)	- (-)	1 (1)	141
Holamangla	19 (14)	38 (23)	20 (15)	0.1 (0.1)	6 (4)	2 (2)	36 (26)	13 (9)	1 (1)	- (-)	0.4 (0.3)	- (-)	1 (1)	136
Bangalore N(½)	5 (9)	16 (29)	9 (16)	0.2 (0.3)	7 (12)	2 (3)	11 (20)	5 (8)	0.4 (0.1)	- (-)	0.4 (1)	- (..)	1 (1)	56

Annexure 4 (contd)

unit = number '000
( ) = % of total livestock

Rainfall Zone IX contd. Rainfall Pattern - $D_1E_3(C_2D_2)C_1D_1E_2$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
TUMKUR														
Tumkur	25 (14)	43 (24)	21 (12)	1 (0.3)	12 (6)	5 (3)	47 (26)	26 (14)	0.2 (0.1)	- (-)	1 (0.3)	- (-)	1 (0.4)	182
Kunigal	22 (10)	37 (16)	17 (7)	1 (0.3)	13 (5)	6 (3)	92 (41)	38 (17)	0.2 (0.1)	- (-)	1 (0.4)	- (-)	1 (0.4)	228
KOLAR														
Chikballapur	13 (14)	15 (16)	7 (8)	0.4 (0.4)	7 (8)	3 (4)	30 (33)	14 (15)	0.2 (0.2)	- (-)	0.4 (0.3)	- (-)	1 (1)	91
TUMKUR														
Koratagere ½ S	8 (15)	10 (18)	5 (10)	0.1 (0.2)	3 (5)	2 (3)	17 (31)	8 (16)	0.1 (0.2)	- (-)	0.2 (0.3)	- (-)	0.4 (1)	54
Gubbi	22 (13)	32 (19)	15 (9)	1 (0.3)	9 (5)	4 (2)	62 (36)	24 (14)	0.4 (0.2)	- (-)	1 (0.4)	- (-)	2 (1)	171
Turvekere	19 (13)	17 (12)	9 (7)	0.3 (0.2)	9 (6)	5 (3)	66 (45)	19 (13)	0.3 (0.2)	- (-)	1 (0.4)	- (-)	1 (0.4)	145

Annexure 4 (contd)

unit = number '1000
( )= % of total livestock
Rainfall Pattern - $D_1E_3(C_2D_2)C_1D_1E_2$

Rainfall Zone IX contd.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
TUMKUR														
Tiptur ½E	11 (17)	10 (15)	6 (10)	0.1 (0.1)	4 (6)	2 (3)	23 (37)	7 (10)	0.1 (0.2)	- (-)	0.4 (1)	- (-)	0.4 (1)	64
KOLAR														
Siddalghatta	15 (13)	11 (10)	8 (6)	0.3 (0.3)	8 (8)	3 (4)	46 (41)	18 (16)	0.3 (0.2)	- (-)	1 (1)	- (-)	1 (1)	112
Gudibanda	6 (16)	6 (16)	4 (11)	0.1 (0.3)	1 (2)	0.4 (1)	13 (36)	5 (14)	- (-)	- (-)	0.2 (1)	- (-)	2 (3)	36
Gauri-bidnur	25 (15)	24 (14)	14 (9)	1 (1)	9 (6)	5 (3)	55 (35)	22 (14)	0.2 (0.1)	- (-)	1 (1)	- (-)	3 (2)	158

Annexure 4 (contd)

Unit = number 1000
( ) = % of total livestock
Rainfall Pattern - $D_1E_3(C_3D_1)C_1E_3$

Rainfall Zone X

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SHIMOGA														
Bhadravati ½E	11 (29)	9 (24)	6 (17)	0.1 (0.3)	4 (11)	2 (5)	2 (4)	3 (3)	0.2 (1)	- (-)	0.1 (0.1)	- (-)	0.1 (0.3)	37
Channagiri ½W	15 (23)	13 (19)	8 (13)	0.4 (0.4)	10 (15)	5 (7)	7 (10)	8 (13)	0.3 (0.4)	- (-)	- (-)	- (-)	- (-)	66
Honnali ½W	12 (21)	10 (18)	8 (13)	1 (1)	9 (16)	4 (7)	6 (10)	7 (12)	0.1 (0.1)	- (-)	1 (2)	- (-)	- (-)	57
DHARWAR														
Byadgi	12 (25)	8 (16)	6 (12)	0.4 (1)	7 (15)	4 (3)	4 (8)	7 (15)	0.2 (0.2)	- (-)	0.1 (0.1)	- (-)	0.1 (0.2)	50
Hirekerur	25 (22)	18 (16)	13 (12)	0.4 (0.4)	17 (15)	8 (7)	14 (12)	16 (15)	0.4 (0.3)	- (-)	0.1 (0.1)	- (-)	0.2 (0.2)	111

Annexure 4 (contd)

Unit= number '000
( )= % of total livestock
Rainfall Pattern - $D_1E_3(E_1C_2E_1)C_1E_3$

Rainfall Zone - XI

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
N.KANARA														
Mundgod ½E	4 (34)	3 (25)	3 (23)	1 (4)	1 (5)	1 (5)	0.2 (1)	0.2 (1)	- (-)	- (-)	- (-)	- (-)	- (-)	13
SHIMOGA														
Bhadra-wathi ½W	11 (29)	9 (24)	6 (17)	0.1 (0.3)	4 (11)	2 (5)	2 (5)	2 (5)	0.2 (1)	- (-)	- (-)	- (-)	0.1 (0.3)	37
Shikarpur	26 (27)	23 (24)	18 (18)	1 (1)	11 (11)	6 (6)	1 (1)	11 (11)	0.2 (0.2)	- (-)	- (-)	- (-)	0.1 (0.1)	97
Shimoga	24 (23)	27 (25)	22 (20)	1 (1)	12 (11)	7 (7)	6 (6)	8 (8)	0.2 (0.2)	- (-)	- (-)	- (-)	0.3 (0.3)	108
DHARWAR														
Hangal	28 (29)	17 (18)	16 (17)	1 (1)	9 (10)	6 (6)	6 (6)	11 (11)	0.3 (0.3)	- (-)	- (-)	- (-)	0.2 (0.2)	95
Kalghatgi	20 (32)	13 (19)	14 (22)	2 (3)	7 (11)	5 (7)	1 (1)	3 (5)	- (-)	- (-)	- (-)	- (-)	- (-)	64
HASSAN														
Belur	30 (28)	36 (33)	23 (21)	0.4 (0.3)	3 (3)	2 (2)	4 (4)	8 (7)	0.4 (0.4)	- (-)	- (-)	- (-)	2 (2)	108
Alur	16 (29)	18 (33)	12 (22)	0.2 (0.4)	3 (5)	2 (3)	0.3 (1)	3 (6)	0.1 (0.1)	- (-)	- (-)	- (-)	0.3 (1)	54
Arkalgud	16 (15)	36 (33)	16 (14)	0.1 (0.1)	9 (8)	4 (4)	12 (11)	15 (14)	1 (0.4)	- (-)	- (-)	- (-)	1 (1)	110

Annexure 4 (contd)

Unit = number '000
( ) = % of total livest

Rainfall Zone- XI contd.

Rainfall Pattern D$_1$E$_3$(B$_1$C$_2$E$_1$) C$_1$E$_3$

1.	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HASSAN														
Belur	30 (28)	36 (33)	23 (21)	0.4 (0.3)	3 (3)	2 (2)	4 (4)	8 (7)	0.4 (0.4)	- (-)	- (-)	- (-)	2 (2)	108
Alur	16 (29)	18 (33)	12 (22)	0.2 (0.4)	3 (5)	2 (3)	0.3 (1)	3 (6)	0.1 (0.1)	- (-)	- (-)	- (-)	0.3 (1)	54
Arkalgud	16 (15)	36 (33)	16 (14)	0.1 (0.1)	9 (8)	4 (4)	12 (11)	15 (14)	1 (0.4)	- (-)	- (-)	- (-)	1 (1)	110

Annexure 4 (contd)

Unit = number '000
( ) = % of total livestock

Rainfall Zone - XII

Rainfall Pattern - $D_1E_1(A_1B_1C_2)C_1E_3$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SHIMOGA														
Sorab 2/3E	23 (31)	17 (22)	13 (13)	2 (2)	7 (9)	4 (5)	2 (2)	8 (11)	0.1 (0.2)	(-)	- (-)	- (-)	0.1 (0.1)	76
N.KANARA														
Mundgod ½W	4 (34)	3 (23)	3 (23)	0.2 (3)	1 (7)	1 (7)	0.2 (1)	0.1 (1)	- (-)	- (-)	- (-)	- (-)	- (-)	12
Haliyal	14 (32)	10 (22)	9 (21)	2 (4)	4 (9)	3 (7)	0.3 (1)	1 (3)	- (-)	- (-)	- (-)	- (-)	0.2 (0.4)	43
BELGAUM														
Belgaum	29 (24)	11 (9)	8 (7)	3 (2)	29 (24)	14 (11)	16 (13)	11 (9)	0.1 (0.1)	- (-)	- (-)	- (-)	0.4 (0.3)	123

Annexure 4 (contd)

Rainfall Zone XIII

Unit = number '000
(   )= % of total livestock
Rainfall Pattern= $D_1E_3(D_2C_1)C_1E_3$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
N. KANARA														
Supa	8 (26)	8 (27)	8 (27)	2 (8)	1 (5)	1 (5)	0.3 (1)	0.4 (1)	- (-)	- (-)	- (-)	- (-)	- (-)	30
Yellapur	10 (20)	12 (24)	11 (22)	3 (7)	7 (14)	5 (11)	1 (1)	0.3 (1)	- (-)	- (-)	- (-)	- (-)	- (-)	48
BELGAUM														
Khanapur	36 (33)	19 (17)	18 (16)	2 (2)	12 (11)	8 (7)	7 (6)	8 (7)	- (-)	- (-)	- (-)	- (-)	0.2 (0.1)	110

Annexure 4 (contd)

Unit = number '000
( ) = % of total livestock

Rainfall Zone - XIV

Rainfall Pattern= $D_1E_3(A_3C_1)C_1D_1E_2$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SHIMOGA														
Sagar ½E	14 (27)	14 (27)	12 (22)	2 (3)	5 (11)	3 (6)	1 (1)	2 (3)	0.2 (0.3)	- (-)	-)-)	-)-)	- (-)	52
Trithahalli 1/3 E	10 (26)	14 (33)	11 (25,	0.3 (1)	3 (7)	2 (4)	0.3 (1)	1 (2)	- (-)	- (-)	- (-)	- (-)	0.3 (1)	62
Hosanagar ½ E	10 (22)	15 (32)	13 (27)	3 (5)	3 (5)	2 (4)	1 (1)	2 (4)	- (-)	- (-)	- (-)	- (-)	0.2 (0.1)	48
Sorab 1/3 W	11 (31)	8 (22)	7 (18)	1 (2)	3 (9)	2 (5)	1 (2)	4 (11)	0.2 (0.2)	- (-)	- (-)	- (-)	0.1 (0.1)	38
N. KANARA														
Sirsi	19 (28)	17 (25)	14 (20)	2 (2)	10 (15)	5 (7)	1 (1)	1 (2)	- (-)	- (-)	- (-)	- (-)	0.1 (0.1)	70

Annexure 4 (contd)

Unit = number '000
( )= % of total livestock
Rainfall Patterns = $D_1 E_3 (A_3 B_1 / C_1 E_3$

Rainfall Zone - XV

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
N. KANARA														
Karwar	9 (32)	5 (18)	5 (18)	3 (12)	3 (10)	2 (6)	0.2 (1)	0.2 (1)	- (-)	- (-)	- (-)	- (-)	0.4 (2)	27

Annexure 4 (contd)

Unit = number '000
( ) = % of total livestock

Rainfall Zone XVI

Rainfall Pattern= $T_1E_3(A_3B_1)C_1D_1E_2$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
N.KANARA														
Ankola	11 (37)	7 (24)	6 (20)	3 (9)	2 (7)	1 (3)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	30
SHIMOGA														
Sagar ½ W	14 (27)	14 (27)	11 (22)	2 (3)	6 (11)	3 (6)	1 (1)	2 (3)	0.2 (0.3)	- (-)	- (-)	- (-)	- (-)	52
Hosanagar ½ W	10 (22)	15 (31)	13 (27)	3 (5)	3 (5)	2 (4)	0.3 (0.4)	2 (4)	0.1 (0.1)	- (-)	- (-)	- (-)	0.1 (0.1)	48
Tritkahalli 2/3 W	21 (26)	28 (34)	21 (25)	1 (1)	6 (7)	3 (4)	1 (1)	1 (1)	- (-)	- (-)	- (-)	- (-)	1 (1)	62
N.KANARA														
Siddapur	15 (29)	13 (25)	9 (19)	1 (1)	8 (15)	3 (7)	0.2 (1)	2 (3)	- (-)	- (-)	- (-)	- (-)	- (-)	51
CHIKMAGLUR														
Koppa	17 (25)	20 (31)	18 (27)	2 (3)	4 (6)	2 (3)	0.2 (0.2)	1 (1)	- (-)	- (-)	- (-)	- (-)	3 (4)	65
Siringeri	3 (21)	5 (33)	4 (26)	0.2 (1)	1 (7)	1 (7)	0.1 ( )	0.1 (1)	- (-)	- (-)	- (-)	- (-)	0.2 (2)	15
Mudigere	19 (30)	17 (25)	13 (20)	4 (6)	4 (6)	2 (3)	0.2 (0.3)	2 (3)	0.1 (0.1)	- (-)	- (-)	- (-)	5 (7)	66

Annexure 4 (contd)

unit = number '000
( ) = % of total livestock

Rainfall Zone - XVII

Rainfall Pattern = $D_1E_3(A_1)C_1D_1E_2$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
U. KANARA														
Bhatkal	5 (21)	6 (24)	5 (20)	3 (12)	3 (12)	1 (4)	0.3 (2)	0.4 (2)	- (-)	- (-)	- (-)	- (-)	- (-)	24
Kumta	12 (30)	11 (29)	9 (23)	2 (5)	3 (9)	1 (4)	0.1 (0.2)	- (-)	- (-)	- (-)	- (-)	- (-)	0.1 (0.1)	39
Honavar	16 (24)	23 (35)	19 (28)	2 (3)	5 (7)	2 (3)	0.2 (0.3)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	67

Annexure 4 (contd)

Unit = number '000
( ) = % of total livestock

Rainfall Zone - XVIII

Rainfall Pattern = $D_2E_2(A_2B_1C_1)C_1D_1E_2$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CHIKMAGALUR														
N. Rajapur	11 (28)	12 (31)	10 (25)	1 (3)	1 (3)	1 (3)	0.3 (1)	1 (3)	- (-)	- (-)	- (-)	- (-)	1 (3)	39

Annexure 4 (contd)

Unit = number '000
( ) = % of total livestock

Rainfall Zone XIX

Rainfall Pattern - $C_1E_3(C_1D_1E_2)C_1D_1E_2$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mandya														
Maddur	23 (15)	24 (16)	10 (6)	1 (1)	17 (12)	7 (5)	44 (30)	18 (13)	1 (0.4)	- (-)	1 (1	- (-)	1 (1)	147
Mandya	43 (19)	24 (11)	10 (5)	1 (0.3)	29 (13)	15 (7)	78 (35)	20 (9)	0.4 (0.2)	- (-)	0.3 (0.1)	- (-)	2 (1)	222
Srirangapatna	13 (18)	16 (22)	7 (10)	0.3 (0.4)	7 (10)	2 (3)	19 (26)	7 (10)	0.2 (0.2)	- (-)	0.3 (0.4)	- (-)	0.3 (0.4)	71
Nagamangala	19 (9)	21 (9)	9 (4)	0.4 (0.2)	14 (6)	6 (3)	123 (54	32 (14)	1 (0.3)	- (-)	0.3 (0.1)	- (-)	1 (0.3)	227
Pandavapura	14 (13)	16 (15)	8 (7)	0.2 (0.2)	9 (8)	4 (3)	43 (39)	16 (15)	0.3 (0.3)	- (-)	0.1 (0.1)	- (-)	1 (1)	111
Malvalli	13 (8)	34 (24)	14 (9)	0.2 (0.2)	16 (11)	6 (4)	40 (28)	21 (15)	0.4 (0.3)	- (-)	0.4 (0.3)	- (-)	0.4 (0.3)	147

Annexure 4 (contd)

Unit = number '000
( ) = % of total livestock
Rainfall Pattern-$C_1E_3(C_2D_2)C_1D_1E_2$

Rainfall Zone XX

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
BANGALORE														
Ramanagaram	7 (6)	30 (29)	14 (13)	0.3 (0.3)	6 (6)	2 (2)	27 (26)	18 (17)	1 (1)	- (-)	0.2 (0.2)	- (-)	0.2 (0.2)	106
Bangalore(S)	5 (10)	14 (24)	7 (12)	1 (1)	5 (8)	2 (4)	18 (31)	5 (9)	1 (0.4)	- (-)	1 (1)	- (-)	1 (0.4)	58
Kanakpura	13 (6)	79 (34)	30 (13)	0.3 (0.1)	6 (3)	3 (1)	42 (18)	55 (24)	1 (0.4)	- (-)	1 (1)	- (-)	0.4 (0.2)	230
Anekal	7 (8)	27 (28)	14 (15)	0.3 (0.3)	8 (8)	3 (3)	26 (27)	10 (10)	0.1 (0.1)	- (-)	1 (1)	- (-)	0.2 (0.2)	97
Channapatna	9 (9)	24 (23)	10 (9)	0.3 (0.3)	9 (9)	4 (4)	31 (30)	15 (14)	1 (1)	- (-)	0.4 (0.4)	- (-)	1 (1)	103
Bangalor(N) (½S)	5 (9)	16 (29)	9 (16)	0.2 (0.3)	7 (12)	2 (3)	11 (20)	5 (8)	0.4 (1)	- (-)	0.4 (1)	- (-)	1 (1)	56

Annexure 4 (contd)

[illegible]
Unit = number '000
(–) = % of total livestock
Rainfall Pattern – $C_1E_3(A_4)C_1D_1E_2$

Rainfall Zone XXI

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S. KANARA														
Buntwal	21	22	20	18	8	5	–	3	–	–	–	–	3	100
	(21)	(22)	(20)	(18)	(8)	(5)	(–)	(3)	(–)	(–)	(–)	(–)	(3)	
Mangalore	7	26	24	17	7	3	–	8	–	–	–	–	3	94
	(8)	(27)	(25)	(18)	(7)	(3)	(–)	(8)	(–)	(–)	(–)	(–)	(3)	
Udipi	14	38	44	28	7	3	0.1	1	–	–	–	–	1	135
	(10)	(28)	(32)	(21)	(5)	(2)	(0.1)	(1)	(–)	(–)	(–)	(–)	(1)	
Coondapur	22	36	32	14	6	3	–	0.2	–	–	–	–	0.4	116
	(19)	(31)	(27)	(13)	(6)	(3)	(–)	(0.2)	(–)	(–)	(–)	(–)	(0.4)	

Rainfall Zone XXII

Unit = number 000
(-) = % of total livestock
Rainfall Pattern= $C_1E_3(A_1)B_1C_1E_2$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S. KANARA														
Karkal	28	36	33	23	8	4	-	1	-	-	-	-	1	134
	(21)	(27)	(24)	(18)	(6)	(3)	(-)	(0.4)	(-)	(-)	(-)	(-)	(1)	
Beltangady	29	23	20	12	4	3	-	2	-	-	-	-	2	96
	(30)	(24)	(21)	(13)	(5)	(3)	(-)	(2)	(-)	(-)	(-)	(-)	(2)	
Puttur	23	18	18	9	5	4	-	5	-	-	-	-	4	84
	(27)	(21)	(21)	(10)	(6)	(5)	(-)	(6)	(-)	(-)	(-)	(-)	(4)	
Sullia	14	13	12	4	4	2	-	4	-	-	-	-	4	57
	(25)	(23)	(21)	(7)	(7)	(4)	(-)	(7)	(-)	(-)	(-)	(-)	(7)	

Annexure 4 (contd)

Unit = number '000
( ) = % of total livestock

Rainfall Zone XXIII

Rainfall Pattern - $C_1D_1E_2(D_2E_2)C_1D_1E_2$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mysore														
Gundlupet	34 (23)	29 (20)	18 (13)	0.2 (0.1)	5 (4)	3 (2)	32 (22)	23 (16)	0.4 (0.2)	- (-)	- (-)	- (-)	0.4 (0.3)	146
Chamarajanagar	30 (18)	35 (21)	18 (10)	1 (0.4)	15 (9)	6 (3)	38 (22)	27 (16)	1 (0.4)	- (-)	0.2 (0.1)	- (-)	1 (0.3)	171

Annexure 4 (contd)

Unit = number '000

( ) = % of total livestock

Rainfall Zone XXIV

Rainfall Pattern - $C_1D_1E_2(C_1D_3)C_1D_1E_2$

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
Mysore														
K.R.Nagar	26 (19)	31 (22)	16 (11)	0.2 (0.1)	10 (7)	5 (3)	30 (22)	20 (14)	(-)	(-)	0.2 (0.1)	- (-)	1 (1)	138
Nanjangud	37 (29)	37 (28)	10 (7)	1 (1)	13 (10)	5 (4)	19 (14)	8 (6)	1 (0.4)	- (-)	0.2 (0.1)	- (-)	0.4 (0.3)	131
T.N.Pura	10 (10)	28 (26)	9 (8)	0.3 (0.3)	14 (13)	5 (5)	31 (29)	10 (9)	- (-)	- (-)	1 (0.4)	- (-)	1 (0.4)	110
Yelendur	4 (18)	6 (23)	3 (11)	0.2 (1)	2 (8)	1 (3)	5 (22)	4 (14)	- (-)	- (-)	0.1 (0.4)	- (-)	- (-)	25
Mysore	26 (15)	36 (21)	20 (11)	0.3 (0.2)	16 (9)	6 (4)	45 (26)	22 (13)	0.4 (0.2)	- (-)	1 (0.4)	- (-)	0.3 (0.2)	172
H.D.Kote	41 (28)	36 (25)	27 (18)	0.3 (0.2)	2 (2)	1 (1)	9 (7)	28 (19)	- (-)	- (-)	(0.1) (0.1)	- (-)	- (-)	145
Hunsur	29 (21)	36 (26)	18 (13)	0.2 (0.2)	4 (3)	2 (1)	19 (14)	29 (21)	0.1 (0.1)	- (-)	- (-)	- (-)	0.2 (0.1)	137

Annexure 4 (contd)

unit = number '000
( ) = % of total livestock

Rainfall Zone XXIV(contd.) Rainfall Pattern - $C_1D_1E_2(C_1D_3)C_1D_1E_2$

	2	3	4	5	6	7	8	9	10	11	12	13	14	1
Patna	22 (17)	41 (33)	19 (15)	0.4 (0.3)	5 (4)	2 (2)	14 (12)	22 (17)	0.2 (0.2)	- (-)	- (-)	- (-)	0.3 (0.2)	12
ndia														
R..et	27 (17)	26 (16)	10 (6)	0.2 (0.1)	15 (9)	6 (4)	49 (32)	24 (15)	1 (0.3)	- (-)	0.2 (0.1)	- (-)	1 (0.3)	15
ssam														
lenursipur	9 (9)	18 (18)	8 (8)	0.1 (0.1)	10 (10)	4 (4)	37 (37)	14 (14)	0.1 (0.1)	- (-)	0.1 (0.1)	- (-)	0.3 (0.3)	10
ssam	34 (21)	40 (24)	21 (13)	0.2 (0.1)	12 (7)	6 (4)	39 (24)	10 (5)	1 (1)	- (-)	0.2 (0.1)	- (-)	1 (1)	164
sore														
llegal	27 (16)	56 (33)	21 (13)	1 (0.4)	9 (6)	4 (2)	29 (17)	20 (12)	0.4 (0.3)	- (-)	0.2 (0.1)	- (-)	0.1 (0.1)	168

Annexure 4 (contd)

nit = number '000
( ) = % of total livestock

Rainfall Zone XXIV(contd.) Rainfall Pattern - $C_1D_1E_2(C_1D_3)C_1D_1E_2$

1	2.	3.	4.	5.	6	7.	8.	9.	10.	11.	12.	13.	14.	15.
HASSAN														
Arsikere	38 (18)	40 (19)	20 (10)	0.4 (0.2)	12 (6)	5 (2)	59 (29)	32 (15)	0.4 (0.2)	- (-)	0.2 (0.1)	- (-)	1 (0.4)	207
C.Patna	27 (12)	66 (28)	12 (5)	0.3 (0.1)	17 (7)	8 (3)	82 (35)	22 (9)	1 (0.4)	- (-)	1 (0.4)	- (-)	1 (0.3)	238
TUMKUR														
Tiptur (½W)	11 (17)	10 (16)	6 (10)	0.1 (0.1)	3 (6)	2 (3)	23 (36)	7 (11)	0.1 (0.2)	(-)	0.4 (0.4)	- (-)	0.4 (0.4)	64

Annexure 4 (contd)

= number '000
( ) = % of total livestock

Rainfall Zone XXV

Rainfall Pattern $-C_1D_1E_2(A_3C_1)C_1D_1E_2$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
COORG														
Virajpet ½E	9 (25)	8 (21)	7 (19)	3 (9)	2 (4)	1 (3)	0.4 (1)	0.4 (1)	neg (0.2)	- (-)	- (-)	- (-)	6 (17)	37
Somvarpet	19 (25)	23 (30)	18 (24)	2 (2)	4 (5)	3 (3)	0.3 (0.4)	4 (5)	0.2 (0.3)	- (-)	- (-)	- (-)	5 (6)	78
HASSAN														
Saklespur	21 (30)	19 (27)	12 (19)	3 (4)	5 (7)	3 (4)	1 (1)	4 (5)	0.2 (0.3)	- (-)	- (-)	- (-)	2 (3)	72
CHIKMAGALUR														
Chikmaglur ½W	15 (26)	15 (26)	11 (19)	1 (2)	3 (5)	1 (2)	4 (7)	6 (10)	0.2 (0.2)	- (-)	0.1 (0.2)	- (-)	2 (3)	59

Annexure 4 (contd)

Unit = number '000
( )= % of total livestock

Rainfall Zone XXVI

Rainfall Pattern - $C_1D_1E_2(A_4)C_1D_1E_2$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
COORG														
Virajpet	9 (25)	8 (21)	7 (19)	4 (9)	2 (4)	1 (3)	0.4 (1)	0.4 (1)	- (-)	- (-)	- (-)	- (-)	6 (17)	37
Mercara	17 (25)	15 (23)	13 (20)	3 (5)	2 (3)	1 (2)	- (-)	1 (1)	- (-)	- (-)	- (-)	- (-)	14 (21)	66

Zonewise Information on Rainfall, Rainy Days and Cropping Patterns of the Concerned Taluks
(Information on Rainfall and Rainy days are based on the Memoirs of the India Meteorological Department, Vol. XXXI, Part III as on 12th May, 1961).

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm/cm)	annual rainfall rd	mmr	mr	nd	consecutive month a	consecutive month b	consecutive month c
Rainfall	Zone I ....Rainfall Pattern $E_4(C_1D_3)D_1E_3$											
$Jr_3B_4Gn_4/C_4$	**Bijapur**											
	Bijapur	2658	600	591	52	34	9	22	13	-	-	-
	Bagevadi	1979	600	450	57	38	9	24	14	-	-	-
	Jam Khandi	1169	600	450	85	38	9	23	13	-	-	-
	Bilgi	782	603	600	51	34	9	21	13	-	-	-
	Mudhol	954	600	566	56	37	9	22	13	-	-	-
	Indi	2225	618	450	56	37	9	25	13	-	-	-
	Sindgi	2176	521	450	55	36	9	24	13	-	-	

elevation = metres above sea level (masl)
= rainy days
mmr = month of maximum rainfall
mr = total rainfall of mmr plus that of preceding or following month, whichever is higher, in cm.
nd = number of raindays of mmr plus that of preceding or following month, whichever has rainfall.

* Consecutive months with rainfall of more 10 cm per month.
a = Initial month with more than 10 cm of rai and number of consecutive months with mor 10 cm/month, separated by hyphen.
b = Total rainfall of consecutive months in ' cm.
c = Total number of rainy days of consecutiv months in (a'
na = not available.

Annexure 5 Contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	nr	nd	consecutive months* a	b	c
Rainfall Zone I. (contd.)					.Rainfall Pattern $E_4(C_1D_3)D_1E_3$							
$C_4Jr_4Jk_4Mt_4/Gn_4/$- $Gn_4Pu_4/B_4/B_4Mt_4$	Muddebihal	1497	600	450	55	38	9	24	13	-	-	-
	Hungund	1354	600	450	57	39	9	24	13	-	-	-
	Bagalkot	936	600	538	54	38	9	23	13	-	-	-
$C_4Jr_4Jk_4Mt_4/Gn_4/$ $Gn_4Pu_4/B_4/B_4Mt_4$	**Raichur**											
	Lingsugur (2/3 W.)	1298	572	450	54	38	9	23	14	8-2	23	14
$Gn_4Jr_4Jk_4B_4/W_4$	**Bijapur**											
	Badami	1394	600	450	57	38	9	24	12	-	-	-

Appendix 5 - Contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	nr	nd	consecutive months* a	b	c
	Rainfall Zone II..(contd.) ... ..Rainfall Pattern $E_4(C_3D_1)D_1E_3$											
$C_4Jr_4Jk_4Mt_4/Gn_4/Gn_4Pu_4/B_4/B_4Mt_4$	Raichur Raichur	1514	401	349	66	44	9	27	17	7-3	39	26
	Deodurg	1508	576	450	69	na	9	31	na	7-3	44	na
$C_3Jr_4Mt_4/Pd_5$	Manvi	1793	472	450	60	na	9	26	na	7-3	37	na
$C_4Jr_4Jk_4Mt\ /Gn_4/-Gn_4\ Pu_4/B_4/B_4\ Mt_4$	Gulbarga Shorapur	1863	569	450	70	na	9	31	na	7-3	41	na
	Shahapur	1461	600	450	74	na	9	31	na	6-4	57	na
	Raichur Lingsugur (1/3E)	649	572	450	54	38	9	23	14	8-2	23	14
$Jr_4Mt_4Gn_4Pu_4$	Gulbarga Yadgir	1708	689	366	67	49	9	28	18	7-3	41	29

Appendix - contd.-

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual total (cm)	rainfall rd	mmr	nr	nd	consecutive months* a	consecutive months* b	consecutive months* c
	Rainfall Zone - III					Rainfall Pattern $E_4(C_4)D_1E_3$						
$Jr_3O_4Gn_4T_4/C_4/T_4B_4$	Gulbarga											
	Aland	1733	593	450	74	na	9	33	na	7-3	54	na
	Gulbarga	1728	454	450	73	45	9	32	17	6-4	56	33
	Afzalpur	1299	523	450	71	na	9	29	na	6-4	55	na
$Jr_3O_4Gn_4T_4/C_4/T_4B_4$	Jevargi (Andola)	1806	464	437	68	na	9	30	na	6-4	52	na
$Jr_3O_4T_4$	Sedam	971	600	450	91	na	9	38	na	6-4	71	na
$Jr_3O_4Gn_4T_4/C_4/T_4B_4$	Chitapur	1792	455	450	80	na	9	33	na	6-4	63	na
$Pu_4T_4Jr_4Gn_4O_4/Jk_4$	Chincholi	1563	453	450	79	na	9	36	na	6-4	66	na

Appendix 5 Contd.

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mmr	mr	md	consecutive month		
			max	min	total (cm)	rd				a	b	c
		Rainfall zone-IV			Rainfall pattern E4(B1C3)D1E3							
$Jr_3G_4Pu_4Jk_5$	Bidar Bidar	926	603	600	91	52	9	40	21	6-4	74	40
$Pu_4Mt_4O_4B_4Jr_4$	Basavakalyan	1199	603	600	59	na	9	27	na	7-3	42	n.a.
$Pu_4T_4Jr_4Gn_4O_4/Jk_4$	Humnabad	987	635	600	93	na	7	39	na	6-4	77	na
$Pu_4G_4Jk_4Jr_4/Jr_5Mt_5Gn_5$	Bhalki	1114	603	600	92	na	9	39	na	6-4	74	na
	Aurad (santpur)	1225	674	600	74	na	7	36	na	6-4	65	na

Annexure 5 Contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	mr	md	consecutive months* a	b	c
	Rainfall Zone - V ....Rainfall Pattern $D_1E_3(D_2E_2)$ $C_1D_1E_2$											
$C_4Mt_4Jr_4Jk_4Pu_4$	**Chitradurga**											
	Hiriyur	1701	600	450	53	34	10	21	11	No consecutive months		
$Pu_4Jk_4Mt_4B_4/Gn_4/R_4Gn_4$	Challakere	2062	1136	900	46	29	10-9	19	10	-do-		

Annexure 5 Contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mnr	mr	md	consecutive* a	consecutive* b	consecutive* c	mor
	Rainfall Zone VI……………………….Rainfall Pattern $D_1E_3(C_1D_3)D_1E_3$												
$C_3Jr_4Mt_4/Pd_5$	Bellary Bellary	1689	454	450	52	33	9-10	23	13	9-2	23	13	
	Siruguppa	1042	600	450	63	40	9	27	14	8-3	37	20	
$C_3Jr_4Mt_4/Pd_5$	Raichur Sindhanur	1602	483	450	60	na	8	27	na	8-3	38	na	
$C_3W_4Jr_4$	Dharwar Nargund	436	603	600	52	37	9	21	12	-	-	-	
$Jk_4C_4Gn_4W_4/Pu_4$ Pd_4Jr_4	Belgaum Saundatti	1581	723	600	61	44	9	22	13	9-2	22	13	
$Jk_4Mt_4B_4Gn_4/C_4/$ C4 Pu_4	Bellery												
	Sandur	939	1100	600	80	na	8	26	na	7-4	52	na	
	Kudligi	1822	839	600	62	47	9	25	17	8-2	25	17	

Annexure 5 Contd.

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mnr	mr	md	consecutive months*		
			max	min	total (cm)	rd				a	b	c
	Rainfall Zone - VI Contd. ....Rainfall Pattern $D_1E_3(C_1D_3)$ D_1E_3											
$Jk_4Mt_4B_4Gn_4/C_4/C_4Pu_4$	Chitradurga Molakalmuru (½N)	370	900	600	59	35	9	26	12	9-2	26	12
$Jk_4C_4Gn_4R_4/Pu_4$	Bellary Harpanahhalli	1432	771	600	62	49	9-10	21	13	9-2	21	13
$Jr_4B_4Jk_4Gn/M_4/W_4$	Belgaum Ramdurg	1215	603	600	57	41	9	20	13	-	-	-
	Gokak	1543	775	600	56	39	10	21	12	-	-	-
$Jr_4B_4Jk_4Gn_4$	Athani	1995	624	600	59	37	9	23	13	-	-	-
$B_4Jk_4M_4Pu_4Gn_4$	Raibag	959	603	600	51	39	9	20	13	-	-	-
$W_3C_4Jk_4/Jr_4$	Dharwar Navalgund	1083	603	600	59	41	9	24	14	9-2	24	14
$Gn_4Jk_4To_4S_5$	Belgaum Chikodi	1269	854	600	63	51	7	21	21	-	-	-

Annexure 3 Contd.

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mnr	nr	nd	consecutive months		
			max	min	total (cm)	rd				a	b	c
	Rainfall Zone VI Contd..				Rainfall Pattern $D_1E_3(C_1E_3)D_1E_3$							
$Gn_3 Jk_4 C_4/W_4/Pu_4$	Dharwar Gadag	1098	603	600	64	45	8	24	14	9-2	24	14
$Gn_4 Jr_4 Jk_4 B_4/W_4$	Ron	1291	719	600	61	41	9	25	14	-	-	-
$C_4 Jk_4 Pu_4 Mt_4 Gn_4/S_4/Pd_4$	Raichur Koppal	1386	600	498	58	na	9	23	na	9-2	23	na
$Gn_3 Jk_4 C_4/W_4/Pu_4$	Bellary Hallapuram	463	498	450	63	na	9	26	na	9-2	26	na
	Hadagalli	1254	972	900	61	46	9	23	14	9-2	23	14
$Gn_3 Jk_4 C_4/W_4/Pu_4$	Dharwar Mundargi	885	600	498	46	33	9-10	19	12	-	-	-

Annexure 5 Contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	rd	mmr	nr	nd	consecutive mont a	b	c
	Rainfall Zone VI Contd.					Rainfall.Pattern $D_1E_3(C_1D_3)D_1E_3$						
$Pu_4Gn_4Mt_4Jk_4W_4C_4$	Raichur Kushtagi	1372	699	600	59	na	9	27	na	9-2	27	na
$C_4Jk_4Pu_4Mt_4Gn_4/S_4$ $/Pd_4$	Yelburga	1490	699	600	65	na	9	28	na	8-3	38	na
	Bellary Hospet	890	633	600	63	na	9	26	16	8-2	26	16
	Raichur Gangavathi	1321	608	450	53	na	10	22	na	9-2	22	na

Annexure 5 Contd.

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mmr	mr	md	consecutive mon		
			max	min	total (cm)	rd				a	b	c
	Rainfall Zone VII......................Rainfall Pattern $D_1E_3(C_1D_3)$ $C_1D_1E_2$											
$Pd_4R_4Jk_4Gn_4/Pu_4$	Chitradurga Davangere	957	600	524	64	46	10	24	13	9-2	24	13
	Harihar	485	524	450	55	41	10-9	19	12	-	-	-
$Pd_4R_4Jk_4Gn_4/ Pu_4$	Shimoga											
	Honnali (1/2 E)	447	1031	900	61	44	10	21	12	-	-	-
	Channagiri (1/2 E)	604	967	600	77	62	7	27	22	7-4	50	43
$Jk_4Mt_4B_4Gn_4/C_4/C_4Pu_4$	Chitradurga											
	Molakalmuru 1/2 S	370	900	600	59	35	9	26	12	9-2	26	12
$Mt_4R_4Jk_4Pu_4$	Jagalur	965	616	450	54	39	9-10	20	12	-	-	-
	Chitradurga	1374	900	600	64	46	10	22	13	9-2	22	13

Annexure 5 (Contd.)

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	mr	md	consecutive months* a	consecutive months* b	consecutive months* c
	Rainfall Zone VII Contd. ....Rainfall Pattern $D_1E_3(C_1D_3)$ $C_1D_1E_2$											
$R_2Pu_4/Pd_4/Pu_4Pd_4$ $/Pu_4Pd_5/Pu_4M_4$	**Kolar**											
	Kolar	777	1226	900	71	47	9-10	25	15	9-2	25	15
	Malur	645	1127	900	73	50	9-10	26	15	9-2	26	15
$R_2Pu_4/Pd_4/Pu_4Pd_4/$ Pu_4Pd_5/Pu_4M_4	**Bangalore**											
	Hoskote	700	914	900	73	48	10-9	27	15	9-2	27	15
$R_3Pu_4Pd_4/L_4$	**Tumkur**											
	C.N. Hally	1130	892	600	71	47	10	26	15	9-2	26	15
$R_3Gn_4Pd_4/Mt_4/$ Pu_4 $/Pu_4Pd_4$	Koratagere (1/2 N)	355	1200	900	66	44	10-9	25	14	9-2	25	14
	Madhugiri	1121	1255	900	72	46	9-10	29	15	9-2	29	15

Annexure 5 (Contd.)

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mmr	mr	md	consecutive months*		
			max	min	total (cm)	rd				a	b	c
	Rainfall Zone - VII. Contd.				..............Rainfall Pattern $D_1E_3(C_1D_3)C_1D_1E_2$							
$R_3Gn_4Pd_4/Mt_4/Pu_4$ $/Pu_4$ Pd_4	**Kolar**											
	Bangarpet	863	1010	900	70	46	10-9	25	15	9-2	25	15
	Srinivaspur	867	950	900	73	48	9-10	27	14	9-2	27	14
	Mulbagal	823	1008	859	76	48	9-10	27	15	8-3	37	22
	Chintamani	868	1338	900	69	45	9-10	26	14	9-2	26	14
$Gn_3B_4R_4$	Bagepalli	943	1202	900	68	43	9	26	14	9-2	26	14
$R_4L_4Pu_4Mt_4/Jk_4/$- Pd_4/Mt_4Jk_4	**Chikmagalur**											
	Kadur	1361	900	600	60	42	10	21	12	-	-	-
	Tarikere	1241	900	600	90	66	7	38	29	6.2	38	29

Annexure 5 (Contd.)

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mmr	mr	md	consecutive months*		
			max	min	total (cm)	rd				a	b	c
	Rainfall Zone - VII Contd. ....Rainfall Pattern $D_1E_3(C_1D_3)$ $C_1D_1E_2$											
$R_4L_4Pu_4Mt_4/Jk_4/-$	Chitradurga Holalkere	1098	900	600	65	49	10	22	14	-	-	-
Pd_4/Mt_4Jk_4	Hosadurga	1429	900	600	61	42	10	21	12	-	-	-
L_3Pd_3	Chikmagalur Chikmagalur (1/2 E)	823	1923	900	92	65	7	29	22	5-3	42	30
$Pu_4Jk_4Mt_4B_4/Gn_4$	Tumkur Pavagada	1358	921	600	56	35	9-10	22	12	9-2	22	12
$/R_4Gn_4$	Sira	1554	649	600	57	36	10-9	23	12	9-2	23	12
$C_3Jk_4Mt_4$	Dharwar Ranibennur	905	600	514	62	49	10	20	13	-	-	-

Annexure 5 (Contd.)

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	mr	md	consecutive month a	consecutive month b	consecutive month c
	Rainfall Zone	VIII...............			Rainfall Pattern $D_1E_3(C_2D_2)$ C_1E_3							
$Pd_4C_4Gn_4Pu_4$	Dharwar Shiggaon	590	707	600	69	61	7	26	27	7-2	26	27
$Jk_4C_4Gn_4W_4/Pu_4$ Pd_4Jr_4	Belgaum Bailhongal	1122	902	600	71	51	7	24	19	6-2, 9-2	24,23	19,
$Jk_4C_4Gn_4W_4/Pu_4$ Pd_4Jr_4	Dharwar Dharwar	119	782	600	81	64	7	30	28	7-4	52	43
	Hubli	738	727	600	67	56	7	21	21	9-2	21	14
$C_4Jk_4Gn_4$	Kundagol	649	654	600	n.a.							
$Jk_4C_4Gn_4R_4/Pu_4$	Haveri	800	600	514	77	60	7	26	26	7-2	26	26
$C_4Jk_4Gn_4$	Savanur	539	700	600	68	55	10	20	13	-	-	-

Annexure 5 (Continued)

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mmr	mr	md	consecutive months*		
			max	min	total (cm)	rd				a	b	c
	Rainfall Zone VIII Contd. ....Rainfall Pattern $D_1E_3(C_2D_2)C_1E_3$											
$Gn_4Jk_4To_4S_5$	**Belgaum**											
	Hukkeri	992	981	600	68	50	7	21	19	9-2	21	13
$Gn_3 Jk_4C_4/W_4/Pu_4$	**Dharwar**											
	Shirahatti	950	713	600	---n.a.---							

Annexure 5 (Continued)

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	rd	mmr	mr	md	consecutive months a	b	c
	Rainfall Zone-IX				Rainfall Pattern D1E3(C2D2)C1D1E2							
$R_2Pu_4/Pd_4/Pu_4Pd_4$ Pu_4Pd_5/Pu_4M4	Bangalore Magadi	826	1226	900	78	52	9-10	30	17	8-3	42	25
	Devanahalli	595	1100	900	75	51	9	28	16	8-3	38	24
	Doddaballapur	768	1099	900	74	49	9-10	28	16	8-3	39	24
	Nelamangale	659	1400	900	76	51	9-10	28	16	8-3	40	24
	Bangalore ½ N	229	910	900	89	58	9-10	32	17	7-2	56	35
	Tumkur											
	Tumkur	1039	1187	-	81	54	9-10	30	17	8-3	42	26
	Kunigal	991	913	600	76	50	10-9	29	16	8-3	41	24
$R_2Pu_4/Pd_4/Pu4\ Pd_4$ Pu_4Pd_5/Pu_4M_4	Kolar Chikballapur	641	900	850	77	54	9	26	18	7-4	48	34

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation (masl) m max	 min	annual rainfall total (cm)	 rd	mmr	srr	md	consecutive months a	 b	 c
	Rainfall Zone -IX contd.				Rainfall Pattern-D1E3(C2D2)C1D1E2							
R3Pu4Pd4/L4	Tumkur											
	Gubbi	1221	900	600	77	50	10-9	28	15	8-3	39	23
	Turuvekere	760	812	600	71	47	10	27	15	9-2	27	15
	Tiptur 1/[illegible]	383	900	812	62	42	10	22	14	-	-	-
-2- R3Gn4Pd4/Mt4-/Pu4/Pu4 Pd4	Kolar											
	Sidlaghata	679	900	850	75	49	9	28	15	8-3	33	23
	Gudibanda	217	900	850	81	49	9	30	17	7-4	53	32
	Gauribidanur	889	1099	600	70	45	9	27	15	8-3	37	22
	Tumkur											
	Koratagere ½ S	355	1200	900	66	44	10-9	25	14	9-2	25	14

Annexure

cropping patterns	district taluk	geographical area (sq km)	elevation max	 min	ann tot (cm
	Rainfall Zone X				
Pd1	Shimoga				
	Bhadrawati (½E)	345	600	567	—
Pd4R4Jk4Cn4/Ru4	Channagiri (½W)	604	967	600	77
	Honnali (½W)	447	1031	900	61
Pd4C4Jk4Mt4Ch4	Dharwar				
	Byadgi	437	640	600	—
	Hirekerur	808	640	524	80

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	mr	md	consecutive months a	b	c
	Rainfall Zone-XI				Rainfall Pattern D1E3(B1C2E1)C1E3							
Pd1	N.Kanara											
	Mundgod (½E)	334	707	300	116	87	7	55	41	6-5	97	74
	Shimoga											
	Bhadravati (½W)	345	600	567	n.a.							
Pd2L4/B4/M5/V4/F4	**Shikaripur**	910	600	500	98	70	7	44	33	6-3	56	44
	Shimoga	1111	567	450	82	63	7	34	25	6-3	44	37
Pd2L4/B4/M5/V4/F4	Dharwar											
	Hanagal	776	640	600	90	69	7	42	33	6-3	56	44
	Kalghatgi	688	782	600	91	72	7	39	34	6-3	52	45

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	mr	md	consecutive months a	consecutive months b	consecutive months c
Rainfall Zone XI contd.						Rainfall Pattern D1E3 (B2C1E1)C1E3						
Pd3R4L4/Pu4	Hassan											
	Belur	803	950	900	100	68	7	37	24	5-4	60	41
	Alur	425	950	900	105	75	7	38	30	5-4	62	47
R3Pi4Pd4/L4	Arkalgud	686	1200	900	95	74	7	35	30	7-2	35	30

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	mr	md	consecutive months* a	consecutive months* b	consecutive months* c
Rainfall Zone -XII					Rainfall Pattern - D1E3(A1B1C2)C1E3							
Pd1	Shimoga											
	Sorab (2/3E)	757	850	600	156	89	7	87	45	6-5	140	78
Pd1	N.Kanara											
	Mundgod (½ W)	334	707	300	116	87	7	55	41	6-5	97	74
	Haliyal	847	668	300	127	88	7	63	42	6-5	107	75
Pd4 R4 F4 Jk5	Belgaum											
	Belgaum	1037	770	600	130	82	7	71	40	6-5	113	69

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mmr	mr	md	consecutive months*		
			max	min	total (cm)	rd				a	b	c
Rainfall Zone - XIII					Rainfall Pattern D1E3(A3C1)C1E3							
Pd1	N.Kanara											
	Supa	1891	883	300	233	101	7	148	51	6-5	217	90
	Yellapur	1301	594	300	251	105	7	156	51	6-5	236	93
Pd2 L4/B4/M5/V4/F4	Belgaum											
	Khanapur	1749	915	600	168	88	7	104	45	6-5	155	78

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	mr	md	consecutive months* a	consecutive months* b	consecutive months* c
Rainfall Zone-XIV					Rainfall Pattern D1E3(A3C1)C1D1E2							
Pd1	Shimoga Sagar ½ E	981	712	600	210	100	7	122	50	6-5	192	88
	Tirthahalli 1/3E	415	932	600	298	108	7	192	53	6-5	280	96
	Hosanagar ½E	711	1343	600	283	103	7	179	46	6-5	268	91
	Sorab 1/3W	384	850	600	156	89	7	87	45	6-5	140	78
Pd2L4/B4/M5/V4 /F4	North Kanara											
	Sirsi	1322	600	300	250	104	7	152	47	6-5	235	94

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mmr	mr	md	consecutive months*		
			max	min	total (cm)	rd				a	b	c
Rainfall Zone-XV					Rainfall Pattern D1E3(A3B1)C1E3							
Pd1	North Kanara											
	Karwar	732	600	150/SL	307	105	7	200	51	6-5	292	97

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mmr	mr	md	consecutive months*		
			max	min	total (cm)	rd				a	b	c
	Rainfall Zone -XVI				Rainfall Pattern D1E3(A3B1)C1D1E2							
Pd2L4/B4/M2/V4/F4	N.Kanara											
	Ankola	919	835	150/SL	330	106	7	215	52	6-5	314	98
	Shimoga											
	Sagar (1/2W)	981	712	600	210	100	7	122	50	6-5	192	88
	Hosanagar (½ W)	711	1343	600	283	103	7	179	46	6-5	268	91
	Tirthahalli (2/3W)	829	932	600	296	108	7	192	53	6-6	280	96
Pd2L4/B4/M5/V4/F4	N.Kanara											
	Siddapur	859	600	150	294	106	7	184	53	6-5	278	96
L3Pd3	Chikmagalur											
	Koppa	582	1200	900	300	113	7	187	53	6-5	277	98
	Sringeri	443	1200	900	370	116	7	230	55	6-5	347	101
L2Pd3	Mudigere	1168	1892	1200	234	114	7	125	48	5-6	217	102

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mmr	mr	md	consecutive month		
			max	min	total (cm)	rd				a	b	c
Rainfall Zone XVII					Rainfall Pattern D1E3(A4)C1D1E2							
Pd1	N.Kanara											
	Bhatkal	349	300	150/SL	385	114	7	237	53	5-6	377	110
	Kumta	583	875	150/SL	373	111	7	234	52	6-5	355	102
Pd2L4/B4/M5/V4/ F4	Honavar	755	875	150/SL	350	114	7	214	55	5-6	342	109

Annexure 5 contd

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	mr	md	consecutive mont a	consecutive mont b	consecutive mont c
Rainfall Zone **XVIII**					Rainfall Pattern D2E2(A2B1C1)C1D1E2							
Pd2L4/B4/M5/V4/F4	Chikmagalur											
	Narasimharajapura	814	1334	900	182	99	7	104	48	6-5	160	84

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mmr	mr	md	consecutive months*		
			max	min	total (cm)	rd				a	b	c
	Rainfall Zone-XIX					Rainfall Pattern - C1E3(C1D1E2)C1D1E2						
Pd4R4Pu4S4/Jk4	Mandva											
	Maddur	618	940	600	68	45	10	29	15	9-2	29	15
	Mandya	715	880	600	69	43	10	27	15	9-2	27	15
	Sriranga-Patna	358	780	600	67	45	10	24	15	-	-	-
R3Pu4Pd4/L4	Nagamangala	1039	929	900	68	41	10	28	14	9-2	28	14
	Pandavapura	527	750	600	69	45	10	29	16	-	-	-
R3Pd4 Pu4L4/Jk4	Malavalli	809	750	600	69	44	10	26	14	9-2	26	14

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mmr	mr	md	consecutive months*		
			max	min	total (cm)	rd				a	b	c
Rainfall Zone-XX					Rainfall Pattern - C1E3(C2D2)C1D1E2							
R2Pu4/Pd4/Pu4Pd4 /Pu4 Pd5/Pu4M4	Bangalore											
	Ramanagaram	631	900	600	84	56	9-10	31	17	8-3	42	25
	Bangalore (s)	618	953	900	89	58	9-10	32	17	7-4	56	35
	Kanakapura	1535	1067	600	81	55	10-9	30	17	8-3	41	25
	Anekal	464	910	900	80	53	10-9	28	16	8-3	39	24
	Bangalore (N) (½S)	229	910	900	89	58	9-10	32	17	7-2	56	35
R3Pd4Pu4Jk4/L4	Channapatna	544	900	600	84	53	10-9	31	17	8-3	43	24

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	 min	annual rainfall total (cm)	 rd	mmr	mr	md	consecutive months* a	 b	 c
Rainfall Zone - XXI					Rainfall Pattern - C1E3(A4)C1D1E2							
Pd1	S.Kanara											
	Buntwal	718	248	3	377	124	7	223	54	5-6	362	115
	Mangalore	554	208	3	340	120	7	199	52	5-6	325	111
	Udipi	926	28	SL	374	119	7	221	53	5-6	362	112
	Coondapur	1560	1343	150 SL	369	114	7	225	53	5-6	358	108

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	 min	annual rainfall total (cm)	 rd	mmr	mr	md	consecutive months* a	 b	 c
	Rainfall Zone-XXII					Rainfall Pattern C1E3(A4)B1C1E2						
Pd1	S.Kanara											
	Karkal	1369	1039	28	469	135	7	264	55	5-7	460	128
	Belthangady	1427	1507	150	458	132	7	256	56	5-7	449	126
Pd2L4/B4/M5/V4/F4	Puthur	997	309	150	386	127	7	217	53	5-7	379	122
	Sullia	830	300	150	n.a							

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	mr	md	consecutive months a	consecutive months b	consecutive months c
Rainfall Zone-XXIII						Rainfall Pattern C1D1E2(D2E2)C1D1E2						
Jk3Pu4R4/Gn4	Mysore											
	Gundlupet	1406	900	600	68	49	10	22	14	No consecutive months		
Jk4Pu4R4Pd4/Gn5Pd5	Chamarajanagar	1231	900	600	68	46	10	24	14	-do-		

Annexure 5 contd.

cropping patterns *	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	mr	md	consecutive months* a	b	c
Rainfall Zone-XXIV					Rainfall Pattern - C1D1E2(C1D3)C1D1E2							
Pd4R4L4/Pu4	Mysore											
	Krishana Raya Nagar	620	756	600	68	48	10	24	14	No.Cons.months		
Jk4 Pu4R4Pd4 /Gn5Pd5	Nanjangud	985	750	600	71	51	10	22	14	-do-		
Pd4R4Pu4S4/ Jk4	Thirumakudlu Narasipur	587	750	600	72	46	10	26	15	9-2	26	15
Nf2Pd4R4	Yelandur	265	750	600					n.a.			
Jk3Pu4R4/Gn4	Mysore	817	775	600	81	57	10	27	17	9-2	27	17
R3Pu4Pd4/L4	Heggadadevanakote	1941	900	600	92	62	7	29	21	7-2	29	21
	Hunsur	982	750	600	76	56	10	23	15	No.Cons months		
	Periyapatna	711	1336	900	85	62	10	24	16	-do-		

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	 min	annual rainfall total (cm)	 rd	mmr	mr	md	consecutive months* a	 b	 c
	Rainfall -XXIV (contd.)				Rainfall Pattern-**C1D1E2(C1D3)C1D1E2**							
R3Pu4Pd4/L4	Mandya											
	Krishnarajpet	916	1093	900	74	49	10	26	15	9-2	26	15
R2Pu4/Pd4/Pu4Pd4 /Pu4Pd5/Pu4M4	Hassan											
	Holenareesipur	601	1068	900	71	52	10	22	14	No.Cons months		
R3Pu4Pd4/L4	Hassan	925	950	900	88	68	10	26	17	9-2	26	17
R3Pu4Nf4	Mysore											
	Kollegal	2736	900	497	82	56	10	29	17	9-2	29	17
R3Pu4Pd4/L4	Hassan											
	Arsikere	1241	975	804	67	48	10	24	16	9-2	24	16
	Channaraypatna	1046	957	900	71	49	10	25	14	9-2	25	14
	Tumkur											
	Tiptur ½W	383	900	812	62	42	10	22	14	No.Cons months		

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation max	elevation min	annual rainfall total (cm)	annual rainfall rd	mmr	mr	md	consecutive months* a	consecutive months* b	consecutive months* c
	Rainfall Zone-XXV				Rainfall Pattern		C1D1E2(A3C1)C1D1E2					
L3Pd3	Coorg											
	Virajpet ½ E	829	1224	450	267	122	7	147	48	5-6	247	107
	Somvarpet	1000	1143	900	218	110	7	121	47	5-6	198	96
L2Pd3	Hassan											
	Sakleshpur	1054	1200	900	235	109	7	131	48	5-6	217	97
L3Pd3	Chikmagalur											
	Chikmaglur 1/2W	822	1923	900	92	65	7	29	22	5-3	42	30

Annexure 5 contd.

cropping patterns	district taluk	geographical area (sq km)	elevation		annual rainfall		mmr	mr	md	consecutive months*		
			max	min	total (cm)	rd				a	b	c
Rainfall Zone -XXVI				Rainfall Pattern-C1D1E2(A4)C1D1E2								
L3Pd3	Coorg											
	Virajpet ½ W	829	1224	450	267	122	7	147	48	5-6	247	107
L2Pd3	Mercara	1450	1745	900	327	132	7	181	56	5-6	306	118

Annexure 6

Areas under Crops in Taluks arranged according to State Rainfall Zones

area = '000 ha
( ) = percent of gross cropped area

Rainfall Zone - I

Rainfall Pattern: E4 (C1 D3) D1 E3

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Bijapur																				
Bijapur	211.3	- (-)	1 (1)	79 (37)	46 (22)	0.4 (0.2)	- (-)	16 (8)	- (-)	- (-)	3 (1)	4 (2)	10 (4)	0.4 (0.2)	12 (6)	13 (6)	24 (11)	- (-)	0.4 (0.2)	1 (1)
Bagevadi	182.2	0.2 (0.1)	7 (4)	60 (33)	35 (19)	0.4 (0.2)	- (-)	20 (11)	- (-)	0.2 (0.1)	3 (2)	2 (1)	4 (2)	- (-)	10 (5)	9 (5)	27 (15)	- (-)	0.3 (.2)	1 (1)
Jamkhandi	92.9	0.3 (0.3)	2 (2)	51 (55)	11 (12)	1 (1)	- (-)	5 (5)	- (-)	- (-)	1 (1)	1 (1)	3 (3)	1 (1)	4 (4)	0.4 (0.3)	9 (9)	- (-)	1 (1)	3 (3)
Bilgi	59.9	- (-)	7 (12)	23 (38)	7 (12)	0.3 (1)	- (-)	4 (7)	- (-)	- (-)	1 (2)	1 (2)	3 (4)	- (-)	3 (5)	2 (4)	8 (13)	- (-)	0.3 (1)	0.2 (.3)
Mudhol	82.5	0.3 (0.4)	6 (7)	30 (36)	9 (11)	4 (5)	- (-)	12 (15)	- (-)	0.2 (0.3)	2 (2)	1 (1)	4 (5)	1 (1)	3 (4)	3 (3)	7 (9)	- (-)	- (-)	1 (1)

Gca = gross cropped area Mc = miscellaneous crops.

Note: 1. Figures in brackets represent percentages to gross cropped area. These have been approximated to the nearest integer except when percentage is less than 0.5. Due to this approximation, the total of percentage values of the crops may differ by a per cent from hundred. **Area statistics relate to the year 1969-70.**

2. For other symbols refer to paragraph 2.7.

3. area negligible or crop not grown.

Annexure 6 (contd.)

Rainfall Zone - I Rainfall Pattern E4 (C1 D3) D1 E3

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Bijapur																				
Indi	199.2	1 (0.3)	- (-)	96 (48)	28 (14)	0.2 (0.1)	- (-)	7 (3)	- (-)	- (-)	2 (1)	4 (2)	7 (4)	0.4 (0.2)	33 (17)	7 (3)	11 (6)	- (-)	- (-)	1 (.4)
.Sindgi	204.1	1 (0.4)	7 (3)	73 (36)	58 (28)	- (-)	- (-)	9 (4)	- (-)	0.4 (0.2)	1 (0.4)	3 (2)	8 (4)	.3 (0.2)	16 (8)	7 (4)	18 (9)	- (-)	0.2 (0.1)	3 (1)
Muddebihal	133.5	0.2 (0.1)	15 (12)	34 (25)	15 (11)	- (-)	- (-)	7 (5)	- (-)	0.3 (0.2)	3 (3)	4 (3)	5 (4)	- (-)	10 (7)	6 (5)	33 (25)	- (-)	0.2 (0.1)	0.1 (neg)
Hungund	121.9	0.1 (0.1)	18 (15)	30 (25)	4 (3)	- (-)	- (-)	7 (6)	- (-)	9 (7)	3 (2)	2 (1)	3 (3)	- (-)	8 (7)	3 (3)	34 (28)	- (-)	- (-)	0.2 (0.1)
Bagalkot	74.1	- (-)	5 (7)	19 (25)	7 (9)	- (-)	- (-)	5 (7)	- (-)	1 (2)	2 (3)	2 (2)	3 (4)	- (-)	4 (6)	7 (9)	18 (25)	- (-)	0.3 (0.4)	1 (1)
Raichur																				
Lingsugar (2/3 w)	79.7	- (-)	11 (14)	8 (10)	12 (15)	- (-)	- (-)	3 (3)	- (-)	10 (13)	2 (3)	5 (6)	- (-)	- (-)	6 (7)	7 (9)	15 (19)	- (-)	- (-)	.1
Bijapur																				
Badami	90.7	1 (1)	8 (9)	17 (18)	14 (16)	- (-)	- (-)	3 (3)	- (-)	4 (3)	1 (1)	3 (3)	6 (7)	0.1 (0.1)	26 (28)	1 (2)	7 (8)	- (-)		0.2 (0.3)

Annexure 6 (contd.)

Rainfall Zone - II Rainfall Pattern - E4 (C3 D1) D1 E3

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gm	O	C	L	F	Mc
Raichur																				
Raichur	103.5	8 (8)	10 (9)	17 (16)	5 (5)	- (-)	- (-)	1 (1)	- (-)	9 (9)	1 (1)	2 (2)	6 (5)	- (-)	7 (7)	5 (5)	31 (30)	- (-)	- (-)	1 (1)
Deodurg	100.6	0.4 (0.4)	10 (10)	22 (22)	6 (6)	- (-)	- (-)	1 (1)	- (-)	12 (12)	3 (3)	4 (4)	2 (2)	- (-)	9 (9)	3 (3)	28 (28)	- (-)	- (-)	0.2 (0.2)
Manoi	153.0	9 (6)	8 (5)	47 (31)	6 (4)	- (-)	- (-)	2 (1)	- (-)	4 (3)	1 (1)	1 (1)	4 (3)	- (-)	7 (5)	2 (1)	61 (40)	- (-)	- (-)	0.2 (0.1)
Gulbarga																				
Shorapur	143.0	0.3 (0.2)	16 (11)	17 (12)	12 (8)	- (-)	- (-)	4 (3)	- (-)	2 (2)	3 (2)	8 (6)	15 (10)	- (-)	21 (15)	10 (7)	32 (23)	- (-)	- (-)	0.1 (0.1)
Shahapur	123.3	1 (1)	13 (11)	26 (22)	3 (3)	- (-)	- (-)	1 (1)	- (-)	7 (6)	0.3 (0.2)	6 (5)	7 (6)	- (-)	23 (19)	7 (6)	28 (23)	- (-)	- (-)	0.2 (0.1)
Raichur																				
Lingsugar 1/3 E	39.7	- (-)	5 (14)	4 (10)	5 (15)	- (-)	- (-)	1 (3)	- (-)	5 (13)	1 (3)	2 (6)	- (-)	- (-)	2 (7)	3 (9)	8 (19)	- (-)	- (-)	Neg. (-)
Gulbarga																				
Yadgir	119.8	4 (3)	6 (5)	29 (24)	7 (6)	- (-)	2 (1)	1 (1)	- (-)	20 (17)	1 (1)	8 (7)	14 (12)	- (-)	21 (17)	5 (4)	2 (1)	- (-)	- (-)	0.4 1

Annexure 6 (contd.)

Rainfall Zone - III

Rainfall Pattern - E4 (C4) D1 E3

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Gulbarga																				
Aland	142.7	2 (1)	5 (4)	40 (28)	19 (13)	- (-)	- (-)	4 (3)	- (-)	4 (3)	5 (4)	17 (12)	7 (5)	1 (.4)	21 (15)	9 (7)	0.2 (0.1)	- (-)	- (-)	8 (5)
Gulbarga	138.4	1 (1)	3 (2)	41 (30)	22 (16)	0.2 (0.1)	0.1 (0.1)	3 (2)	- (-)	2 (2)	2 (1)	18 (13)	13 (9)	0.2 (0.1)	16 (12)	11 (8)	3 (2)	- (-)	- (-)	3 (2)
Afzalpur	105.3	0.3 (0.3)	- (-)	35 (34)	9 (9)	- (-)	- (-)	5 (5)	- (-)	0.4 (0.4)	6 (6)	4 (3)	2 (2)	0.4 (0.4)	11 (11)	16 (15)	15 (14)	- (-)	- (-)	1 1
Jewargi	152.5	0.3 (0.2)	3 (2)	43 (28)	9 (6)	- (-)	- (-)	6 (4)	- (-)	1 (0.4)	5 (3)	10 (7)	7 (5)	- (-)	12 (8)	20 (13)	35 (23)	- (-)	- (-)	1 (0.4)
Sedam	71.5	1 (2)	1 (1)	19 (27)	1 (2)	- (-)	1 (1)	1 (2)	- (-)	2 (3)	3 (4)	18 (25)	5 (7)	- (-)	3 (4)	12 (17)	- (-)	- (-)	- (-)	3 (4)
Chitapur	148.0	0.3 (0.2)	3 (2)	44 (30)	18 (12)	- (-)	- (-)	3 (2)	- (-)	2 (1)	6 (4)	30 (20)	7 (5)	- (-)	13 (9)	17 (12)	0.3 (0.2)	- (-)	- (-)	5 (3)
Chincholi	97.8	1 (1)	4 (4)	16 (17)	5 (6)	- (-)	- (-)	1 (1)	- (-)	6 (6)	5 (5)	16 (16)	20 (20)	0.2 (0.2)	6 (6)	11 (11)	- (-)	- (-)	-	7 (7)

Annexure 6 (contd-)

Rainfall Zone - IV

Rainfall Pattern - E4 (B1 C3) DI E3

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Bidar																				
Bidar	84.0	2 (3)	6 (7)	31 (36)	3 (4)	- (-)	- (-)	1 (2)	- (-)	2 (3)	14 (17)	3 (3)	8 (10)	3 (3)	5 (6)	2 (3)	- (-)	- (-)	- (-)	2 (3)
Basava kalyan	71.2	4 (6)	5 (7)	8 (11)	8 (12)	0.1 (0.2)	- (-)	1 (1)	1 (2)	10 (14)	4 (6)	1 (1)	14 (19)	1 (1)	2 (2)	8 (13)	2 (3)	- (-)	- (-)	1 (2)
Humnabad	45.4	1 (3)	4 (9)	4 (9)	2 (5)	0.4 (1)	0.1 (0.3)	2 (4)	1 (1)	1 (2)	3 (6)	4 (9)	10 (21)	2 (4)	9 (20)	2 (4)	- (-)	- (-)	- (-)	1 (2)
Bhalki	87.0	1 (1)	10 (12)	9 (11)	1 (1)	- (-)	- (-)	2 (2)	.4 (0.4)	1 (1)	16 (18)	5 (6)	26 (30)	0.4 (0.4)	9 (10)	2 (3)	2 (3)	- (-)	- (-)	1 (1)
Aurad	119.2	2 (2)	18 (15)	8 (6)	0.4 (0.3)	0.4 (0.3)	- (-)	0.2 (0.2)	- (-)	9 (8)	15 (13)	4 (3)	28 (23)	- (-)	8 (7)	6 (5)	7 (6)	- (-)	- (-)	13 (11)

Annexure 6 (continued)

Rainfall Zone - V Rainfall Pattern - D1 E3 (D2 E2) C1 D1 E2

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	M
Chitradurga																				
Miriyur	54.1	2 (4)	4 (8)	4 (8)	4 (8)	- (-)	3 (5)	0.1 (0.3)	- (-)	8 (14)	1 (1)	2 (4)	5 (10)	1 (2)	2 (4)	2 (3)	13 (24)	2 (4)	- (-)	1 (2)
Challakere	79.4	3 (3)	15 (18)	0.2 (0.3)	13 (16)	- (-)	4 (5)	- (-)	- (-)	11 (15)	- (-)	4 (5)	16 (21)	- (-)	4 (5)	3 (4)	5 (6)	1 (1)	- (-)	1 (1)

Annexure 6 (contd.)

Rainfall Zone - VI Rainfall Pattern - D1 E3 (C1 D3) D1 E3

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Bellary																				
Bellary	146.3	4 (3)	16 (11)	28 (19)	4 (3)	1 (1)	0.3 (0.1)	0.4 (0.3)	- (-)	25 (17)	- (-)	0.2 (0.1)	1 (0.4)	1 (0.4)	8 (5)	- (-)	55 (38)	- (-)	- (-)	2 (1)
Siruguppa	81.7	10 (12)	3 (4)	15 (18)	3 (4)	- (-)	- (-)	0.1 (0.2)	- (-)	12 (14)	- (-)	0.1 (0.2)	0.1 (0.2)	2 (2)	5 (6)	0.3 (0.3)	31 (38)	- (-)	- (-)	Neg (-)
Raichur																				
Sindhanur	128.1	12 (9)	9 (7)	30 (23)	4 (3)	1 (.4)	- (-)	1 (1)	- (-)	4 (3)	2 (2)	3 (3)	6 (5)	1 (1)	5 (4)	3 (2)	46 (36)	- (-)	- (-)	1 (1)
Dharwar																				
Nargund	41.4	- (-)	1 (3)	9 (23)	- (-)	- (-)	- (-)	13 (31)	- (-)	- (-)	2 (4)	0.2 (0.4)	1 (3)	- (-)	0.4 (1)	3 (6)	11 (27)	- (-)	- (-)	0.2 (1)
Belgaum																				
Saundatti	129.0	0.1 (0.1)	18 (14)	9 (7)	12 (10)	0.2 (0.1)	- (-)	20 (16)	- (-)	9 (7)	2 (2)	3 (2)	8 (6)	1 (.4)	16 (12)	4 (3)	24 (18)	- (-)	- (-)	2 (2)
Bellary																				
Sandur	39.7	1 (3)	9 (24)	1 (2)	7 (18)	0.2 (0.4)	2 (5)	- (-)	- (-)	7 (18)	- (-)	1 (3)	3 (8)	0.4 (1)	2 (6)	0.4 (1)	4 (10)	- (-)	- (-)	0.4 (1)

Annexure 6 (contd.)

Rainfall Zone - VI Contd :

Rainfall Pattern - D1 E3 (C1 D3)D1 E3

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Bellary																				
Kudligi	84.5	2 (3)	17 (20)	1 (1)	12 (14)	0.3 (.3)	1 (2)	0.2 (0.3)	- (-)	12 (13)	0.1 (0.1)	3 (4)	6 (7)	0.2 (0.3)	17 (20)	3 (3)	8 (10)	1 (1)	- (-)	2 (2)
Chitradurga																				
Molakalmuni ½N	18.2	1 (6)	5 (28)	- (-)	2 (11)	- (-)	0.3 (2)	- (-)	- (-)	3 (12)	- (-)	0.4 (3)	2 (11)	- (-)	2 (8)	0.4 (2)	2 (12)	- (-)	- (-)	1 (5)
Bellary																				
Harpanahalli	90.9	2 (3)	28 (31)	4 (4)	1 (1)	- (-)	11 (12)	0.1 (0.1)	- (-)	9 (10)	- (-)	2 (2)	8 (9)	0.2 (0.2)	12 (14)	2 (2)	9 (10)	0.1 (0.1)	- (-)	2 (2)
Belgaum																				
Ramdurg	94.2	0.3 (0.4)	7 (8)	20 (21)	12 (12)	1 (1)	0.4 (0.4)	13 (14)	- (-)	3 (4)	2 (2)	2 (2)	8 (8)	1 (1)	13 (14)	5 (5)	7 (7)	- (-)	- (-)	0.4 (0.4
Gokak	114.2	1 (1)	14 (12)	26 (23)	16 (14)	10 (8)	- (-)	7 (6)	- (-)	4 (4)	2 (2)	2 (2)	6 (5)	3 (2)	11 (10)	2 (2)	6 (5)	- (-)	0.3 (0.2)	5 (4
Athni	161.4	1 (0.4)	26 (16)	35 (22)	29 (18)	1 (1)	- (-)	9 (6)	- (-)	- (-)	6 (4)	3 (2)	9 (6)	5 (4)	19 (12)	4 (3)	10 (6)	- (-)	0.3 (0.2)	3 (2
Raibag	70.6	0.4 (1)	13 (19)	5 (8)	16 (22)	8 (11)	- (-)	3 (4)	- (-)	0.1 (0.1)	1 (1)	1 (2)	7 (10)	3 (4)	7 (10)	1 (1)	2 (3)	- (-)	- (-)	3 (4
Dharwar																				
Navalgund	104.8	0.1 (0.1)	13 (12)	10 (9)	- (-)	- (-)	- (-)	39 (37)	- (-)	- (-)	2 (2)	1 (1)	3 (3)	- (-)	5 (5)	5 (5)	25 (24)	- (-)	- (-)	1 (1

Annexure 6 (contd.)

Rainfall Zone - VI Contd.

Rainfall Pattern - D1 E3 (C1 D3)D1 E3

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	At
Belgaum																				
Chikodi	101.5	2 (2)	21 (21)	2 (2)	3 (3)	1 (1)	0.4 (0.4)	1 (1)	- (-)	3 (3)	2 (2)	4 (4)	5 (5)	8 (8)	27 (27)	1 (1)	0.4 (0.4)	- (-)	2 (2)	18 (17)
Dharwar																				
Gadag	100.1	0.2 (0.2)	15 (15)	5 (5)	0.2 (0.2)	- (-)	- (-)	13 (13)	- (-)	1 (1)	1 (1)	2 (2)	4 (4)	0.1 (0.1)	19 (19)	3 (2)	35 (35)	- (-)	0.4 (0.4)	1 (1)
Ron	121.3	0.4 (0.3)	12 (11)	19 (16)	0.4 (0.4)	- (-)	- (-)	16 (13)	- (-)	1 (1)	4 (3)	2 (1)	7 (6)	- (-)	19 (16)	4 (3)	37 (31)	- (-)	- (-)	0.4 (.4)
Raichur																				
Koppal	93.7	1 (1)	14 (15)	2 (2)	2 (2)	0.1 (0.1)	- (-)	4 (6)	- (-)	15 (15)	1 (1)	2 (2)	14 (15)	2 (2)	17 (18)	3 (3)	15 (16)	- (-)	- (-)	0.4 (1)

Annexure 6 (contd.)

Rainfall Zone - VI

Rainfall Pattern - D1 E3 (C1 D3)D1 E3

District/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	E	C	L	F	Mc
Ballary																				
Mallapuram	21.7	0.3 (1)	4 (17)	- (-)	1 (5)	0.1 (0.4)	- (-)	0.1 (0.4)	- (-)	3 (13)	- (-)	0.4 (2)	4 (18)	0.1 (1)	8 (38)	0.2 (1)	1 (4)	- (-)	- (-)	n (
Hadagalli	90.2	0.4 (1)	21 (23)	0.3 (0.4)	2 (2)	0.2 (0.3)	0.2 (0.2)	0.2 (0.2)	- (-)	10 (11)	0.3 (0.4)	1 (1)	11 (12)	0.3 (0.4)	24 (26)	1 (1)	17 (19)	0.1 (0.1)	- (-)	(
Dharwar																				
Mundargi	64.8	0.1 (0.2)	13 (20)	2 (3)	1 (1)	- (-)	- (-)	4 (7)	- (-)	3 (5)	0.4 (1)	1 (2)	5 (7)	0.1 (0.1)	16 (24)	2 (3)	17 (26)	- (-)	- (-)	C (
Raichur																				
Kushtagi	115.4	0.3 (0.2)	11 (9)	7 (6)	9 (8)	- (-)	- (-)	10 (9)	- (-)	11 (9)	2 (2)	6 (7)	24 (21)	- (-)	15 (13)	7 (6)	10 (9)	- (-)	- (-)	(
Yelburga	124.2	1 (.4)	14 (11)	3 (2)	2 (2)	- (-)	- (-)	9 (7)	- (-)	17 (14)	2 (1)	3 (2)	16 (13)	- (-)	25 (20)	5 (4)	27 (22)	- (-)	- (-)	(

Annexure 6 Contd.

Rainfall Zone VI Contd.

Rainfall Pattern D1E3(C1D3)D1E3

district/ taluk	Gca	Pd	Jk	Jr	G	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	Misc. crops
Bellary																			
Hospet	47.9	5 (11)	9 (20)	1 (2)	2 (4)	1 (1)	- (-)	0.4 (1)	- (-)	6 (13)	- (-)	1 (2)	3 (7)	6 (13)	2 (4)	- (-)	10 (21)	- (-)	1 (1)
Raichur																			
Ganga-vathi	101.3	22 (21)	14 (14)	3 (3)	4 (4)	- (-)	- (-)	0.2 (0.2)	- (-)	9 (9)	0.3 (0.3)	1 (1)	9 (9)	3 (3)	15 (15)	1 (2)	18 (18)	- (-)	1 (1)

Annexure 6 Contd.

Rainfall Zone VII

Rainfall Pattern D1E3(C1D3)C1D1E2

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F.	Mc.
Chitra-durga																				
Devangere	58.3	20 (34)	4 (6)	0.3 (0.4)	0.1 (0.2)	0.4 (1)	14 (24)	- (-)	- (-)	2 (4)	- (-)	0.4 (1)	1 (2)	1 (1)	10 (18)	1 (.4)	3 (6)	0.3 (1)	- (-)	1 (2)
Harihar	45.0	13 (23)	8 (18)	1 (2)	- (-)	0.2 (0.4)	4 (9)	- (-)	- (-)	3 (7)	- (-)	1 (2)	1 (3)	0.1 (0.3)	9 (20)	- (-)	3 (5)	- (-)	- (-)	2 (3)
Shimoga																				
Honnali ½E	29.2	7 (27)	4 (15)	0.4 (2)	- (-)	- (-)	4 (13)	- (-)	- (-)	2 (7)	- (-)	0.4 (2)	3 (10)	1 (1)	3 (13)	0.4 (2)	1 (3)	- (-)	- (-)	9 (6)
Channagiri ½E	43.8	11 (24)	10 (22)	1 (2)	- (-)	- (-)	9 (20)	- (-)	- (-)	1 (3)	1 (2)	1 (2)	3 (7)	0.2 (0.3)	1 (4)	1 (2)	2 (6)	0.4 (1)	- (-)	2 (5)
Chitra-durga																				
Molakalmuru ½S	18.1	1 (6)	5 (29)	- (-)	2 (11)	- (-)	0.2 (1)	- (-)	- (-)	2 (13)	- (-)	0.4 (3)	2 (11)	- (-)	2 (9)	0.2 (2)	2 (13)	- (-)	- (-)	0.4 (2)
Jagalur	48.5	0.4 (1)	9 (19)	3 (6)	2 (4)	- (-)	7 (14)	- (-)	- (-)	12 (26)	- (-)	3 (6)	5 (11)	- (-)	2 (4)	3 (5)	0.3 (1)	0.1 (0.3)	- (-)	1 (3)
Chitra-durga																				
Chitra-durga	77.8	1 (1)	16 (21)	3 (4)	3 (4)	0.2 (0.3)	13 (17)	0.1 (0.2)	- -	16 (21)	1 (1)	4 (5)	7 (9)	0.1 (0.1)	1 (1)	2 (2)	7 (9)	1 (1)	- (-)	2 (3)
Kolar																				
Kolar	25.0	2 (3)	0.1 (0.4)	1 (3)	- (-)	1 (3)	14 (57)	- (-)	- (-)	0.2 (1)	1 (3)	- (-)	3 (11)	- (-)	2 (7)	0.2 (1)	- (-)	- (-)	- (-)	2 (6)

Annexure 6 contd.

Rainfall Zone VII contd. Rainfall Pattern D1E3(C1D3)C1D1E2

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	Q	T	Pu	S	Gn	O	C	L	F	Mc.
Malur	31.6	3 (10)	0.2 (1)	- (-)	- (-)	0.4 (1)	15 (47)	- (-)	- (-)	2 (6)	- (-)	1 (3)	5 (16)	0.1 (0.2)	1 (2)	1 (2)	- (-)	- (-)	0.4 (1)	3 (10)
Bangalore																				
Hoskote	42.3	4 (9)	- (-)	- (-)	- (-)	0.4 (1)	21 (50)	0.3 (1)	- (-)	2 (4)	- (-)	- (-)	7 (16)	- (-)	0.2 (0.4)	0.1 (0.3)	- (-)	- (-)	2 (5)	6 (13)
Tumkur																				
C.N.Hally	51.2	1 (3)	3 (6)	- (-)	1 (2)	- (-)	18 (35)	- (-)	- (-)	5 (10)	0.2 (0.3)	1 (3)	7 (14)	- (-)	0.4 (1)	1 (2)	- (-)	11 (21)	- (-)	1 (3)
Koratgere ½N	17.6	3 (18)	0.4 (2)	- (-)	- (-)	- (-)	7 (42)	- (-)	- (-)	2 (11)	- (-)	- (-)	1 (5)	0.1 (1)	2 (14)	1 (4)	- (-)	0.2 (1)	- (-)	0.4 (2)
Madhugiri	48.0	6 (13)	5 (10)	0.1 (0.2)	- (-)	0.1 (0.2)	12 (25)	0.1 (0.2)	- (-)	4 (8)	1 (2)	1 (2)	8 (17)	1 (2)	8 (17)	- (-)	- (-)	0.1 (0.2)	- (-)	2 (4)
Kolar																				
Bangarpet	30.3	7 (22)	1 (2)	- (-)	- (-)	- (-)	11 (36)	- (-)	- (-)	3 (10)	- (-)	1 (2)	4 (13)	1 (2)	3 (9)	- (-)	- (-)	- (-)	- (-)	1 (3)
Sriniva-spur	26.4	3 (13)	0.3 (1)	0.2 (1)	0.4 (2)	0.2 (1)	11 (42)	- (-)	- (-)	2 (6)	- (-)	0.1 (0.3)	2 (7)	0.3 (1)	4 (15)	0.1 (0.3)	- (-)	- (-)	- (-)	3 (10)
Mulbagal	30.2	5 (16)	1 (3)	- (-)	- (-)	- (-)	10 (35)	- (-)	- (-)	3 (9)	- (-)	0.2 (1)	3 (10)	1 (2)	5 (17)	0.2 (1)	- (-)	0.2 (1)	- (-)	2 (5)
Chintamani	35.8	2 (7)	1 (2)	- (-)	1 (4)	0.3 (1)	16 (44)	- (-)	- (-)	1 (4)	- (-)	0.2 (1)	3 (8)	- (-)	6 (16)	- (-)	- (-)	- (-)	- (-)	5 (13)

Annexure 6 contd.

Rainfall Zone VII contd.

Rainfall Pattern D1E3(C1D3)C1D1E2

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc.
Bagepalli	31.1	2 (7)	0.3 (1)	- (-)	8 (24)	0.4 (1)	4 (14)	- (-)	- (-)	2 (5)	- (-)	1 (2)	2 (7)	0.4 (1)	11 (35)	- (-)	- (-)	- (-)	0.4 (1)	0. (1.0
Chikmagalur Kadur	86.5	3 (4)	13 (15)	3 (3)	0.2 (0.1)	0.2 (0.1)	17 (20)	0.2 (0.1)	- (-)	4 (5)	1 (1)	1 (1)	14 (16)	0.4 (1)	4 (5)	5 (6)	0.2 (1)	14 (17)	- (-)	5 (5)
Tarikere	47.9	9 (18)	5 (10)	- (-)	- (-)	- (-)	12 (25)	0.1 (0.2)	- (-)	1 (2)	1 (2)	1 (2)	7 (14)	1 (2)	1 (3)	1 (2)	- (-)	6 (11)	- (-)	4 (3)
Chitradurga Holalkere	52.9	1 (1)	7 (14)	1 (1)	1 (2)	- (-)	14 (26)	- (-)	- (-)	9 (16)	1 (2)	2 (3)	5 (9)	0.1 (0.1)	2 (3)	3 (6)	2 (5)	2 (4)	- (-)	4 (8)
Hosadurga	60.5	1 (2)	7 (11)	1 (1)	2 (3)	- (-)	11 (19)	- (-)	- (-)	9 (14)	0.2 (0.4)	2 (3)	9 (16)	- (-)	1 (2)	4 (6)	0.3 (0.4)	11 (18)	- (-)	3 (4)
Chikmagalur Chikmagalur ½E	25.8	6 (24)	1 (4)	0.1 (0.4)	- (-)	- (-)	4 (15)	- (-)	- (-)	- (-)	- (-)	- (-)	1 (4)	0.1 (1)	0.4 (2)	1 (3)	- (-)	11 (42)	- (-)	2 (5)
Tumkur Pavagada	61.6	3 (5)	10 (16)	- (-)	2 (3)	- (-)	4 (7)	- (-)	- (-)	12 (19)	- (-)	2 (4)	14 (22)	- (-)	12 (20)	1 (2)	- (-)	- (-)	- (-)	1 (2)
Sira	43.4	4 (10)	3 (7)	1 (2)	- (-)	- (-)	4 (10)	- (-)	- (-)	7 (16)	- (-)	1 (3)	13 (30)	0.4 (1)	4 (10)	1 (1)	1 (2)	1 (2)	- (-)	3 (6)
Dharwar Ranibennur	70.3	0.3 (0.4)	16 (22)	7 (10)	0.1 (0.2)	- (-)	1 (1)	0.2 (0.2)	- (-)	9 (13)	- (-)	2 (3)	7 (10)	- (-)	4 (6)	1 (0.3)	16 (23)	- (-)	1 (1)	6 (9)

Annexure 6 contd.

Rainfall Zone VIII

Rainfall Pattern D1E3(C2D2)C1E3

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc.
Dharwar Shiggaon	40.8	10 (25)	1 (3)	8 (20)	- (-)	- (-)	2 (4)	1 (2)	- (-)	2 (6)	- (-)	1 (2)	4 (10)	0.1 (0.2)	5 (11)	0.2 (1)	4 (9)	- (-)	2 (5)	1 (2)
Belgaum Bailhongal	101.6	9 (9)	15 (15)	9 (9)	1 (1)	- (-)	0.1 (0.1)	5 (5)	- (-)	8 (8)	1 (1)	2 (2)	14 (14)	3 (3)	17 (16)	0.3 (1)	10 (10)	- (-)	5 (5)	- -
Dharwar Dharwar	84.5	12 (15)	18 (21)	4 (5)	0.1 (0.1)	- (-)	0.2 (0.2)	11 (13)	- (-)	2 (2)	1 (1)	2 (2)	8 (9)	0.4 (1)	6 (7)	1 (2)	6 (7)	- (-)	8 (10)	3 (4)
Hubli	68.3	2 (4)	14 (21)	4 (6)	- (-)	- (-)	0.2 (0.3)	9 (14)	- (-)	1 (2)	0.1 (0.1)	2 (3)	7 (11)	- (-)	7 (10)	2 (2)	13 (20)	- (-)	2 (3)	3 (4)
Kundagol	61.6	1 (1)	13 (22)	3 (5)	0.1 (0.1)	- (-)	0.3 (1)	8 (13)	- (-)	1 (1)	0.2 (0.4)	2 (3)	3 (5)	- (-)	8 (14)	1 (2)	19 (30)	- (-)	- (-)	2 (3)
Haveri	66.3	2 (2)	14 (21)	7 (11)	0.2 (0.3)	- (-)	0.4 (1)	0.2 (0.3)	- (-)	6 (9)	0.1 (0.1)	1 (2)	8 (12)	0.1 (0.2)	7 (10)	0.4 (1)	14 (22)	- (-)	1 (2)	5 (7)
Savanur	47.4	0.4 (1)	10 (20)	6 (12)	0.1 (0.1)	- (-)	0.4 (1)	0.3 (1)	- (-)	4 (9)	- (-)	1 (3)	5 (11)	0.1 (0.2)	10 (20)	1 (2)	7 (15)	- (-)	0.3 (1)	2 (4)
Belgaum Hukkeri	69.7	2 (3)	17 (25)	0.2 (0.5)	2 (3)	1 (1)	1 (1)	0.1 (0.2)	1 (1)	2 (2)	- (-)	2 (3)	4 (5)	3 (5)	21 (31)	0.1 (0.2)	1 (1)	- (-)	1 (2)	(10) (16)
Dharwar Shirahatti	76.5	0.3 (0.4)	20 (26)	2 (3)	0.1 (0.1)	- (-)	0.2 (0.2)	3 (4)	- (-)	4 (4)	0.4 (1)	2 (3)	7 (9)	0.1 (0.2)	24 (31)	1 (2)	13 (17)	- (-)	- (-)	- (-)

Annexure 6 (contd.)

Rainfall Zone - IX

Rainfall Pattern D1E3(C2D2)C1D1E2

District/ taluk	Gca	Pd	Jk	Jr	S	M	R	W	Ba	Mt	S	T	Pu	S	Gn	O	C	L	F	Mc.
Bangalore																				
Magadi	44.7	5 (11)	- (-)	- (-)	- (-)	1 (2)	26 (58)	- (-)	- (-)	2 (4)	- (-)	1 (2)	3 (7)	1 (1)	1 (2)	1 (2)	- (-)	- (-)	2 (5)	2 (5)
Devanhalli	23.2	3 (11)	- (-)	- (-)	- (-)	0.3 (1)	12 (54)	- (-)	- (-)	0.4 (2)	- (-)	0.3 (2)	4 (15)	0.1 (0.3)	0.4 (2)	0.4 (2)	- (-)	0.1 (0.4)	0.4 (2)	2 (8)
Dodballapur	40.5	4 (10)	- (-)	- (-)	- (-)	0.3 (1)	21 (53)	0.1 (-)	- (-)	3 (8)	- (-)	0.2 (1)	2 (4)	1 (2)	1 (3)	1 (2)	- (-)	- (-)	2 (5)	4 (11)
Nelamangala	39.7	4 (9)	- (-)	- (-)	- (-)	1 (2)	24 (60)	- (-)	- (-)	1 (3)	- (-)	0.3 (1)	5 (12)	0.3 (1)	1 (2)	1 (2)	- (-)	- (-)	1 (2)	2 (6)
Bangalore ½N	11.0	1 (9)	- (-)	- (-)	- (-)	0.2 (2)	6 (60)	- (-)	- (-)	0.2 (2)	- (-)	0.1 (1)	1 (10)	0.1 (1)	0.1 (1)	0.1 (1)	- (-)	- (-)	1 (8)	0.4 (5)
Tumkur																				
Tumkur	57.2	8 (14)	1 (2)	1 (2)	- (-)	- (-)	29 (50)	- (-)	- (-)	1 (2)	- (-)	1 (2)	8 (14)	0.1 (0.2)	2 (4)	1 (2)	— (-)	1 (2)	1 (3)	2 (3)

Annexure 6 (contd.)

Rainfall Zone IX contd. Rainfall Pattern D1E3(C2D2)C1D1E2

District/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Tumkur																				
Kunigal	47.9	6 (14)	2 (3)	- (-)	- (-)	- (-)	26 (54)	- (-)	- (-)	1 (2)	- (-)	1 (2)	8 (17)	1 (2)	0.4 (1)	1 (1)	- (-)	0.3 (1)	- (-)	1 (3)
Kolar																				
Chikballapur	17.2	1 (6)	0.1 (1)	0.1 (1)	- (-)	2 (10)	9 (50)	- (-)	- (-)	- (-)	- (-)	0.1 (1)	1 (7)	0.1 (1)	1 (7)	- (-)	- (-)	- (-)	- (-)	3 (16)
Tumkur																				
Gubbi	59.4	5 (8)	3 (4)	- (-)	- (-)	- (-)	24 (41)	- (-)	- (-)	3 (5)	1 (2)	- (-)	12 (21)	0.2 (.4)	2 (4)	2 (3)	- (-)	4 (7)	- (-)	2 (4)
Turuvekere	43.6	2 (5)	2 (5)	- (-)	- (-)	0.3 (1)	17 (40)	0.2 (0.4)	- (-)	3 (8)	- (-)	1 (2)	8 (18)	- (-)	- (-)	1 (3)	- (-)	7 (15)	- (-)	1 (3)
Tiptur ½E	15.0	1 (7)	0.4 (4)	- (-)	- (-)	- (-)	4 (30)	- (-)	- (-)	0.1 (1)	- (-)	0.1 (1)	2 (12)	- (-)	0.1 (1)	0.2 (1)	- (-)	6 (40)	0.1 (1)	0.2 (1)

Annexure 6 (contd.)

Rainfall Zone - IX contd.

Rainfall Pattern D1E3(C2D2)C1D1E2

District/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	E	F	Mc
Kolar																				
Siddlaghata	22.3	1 (6)	- (-)	0.4 (2)	0.3 (1)	1 (4)	10 (46)	0.1 (1)	- (-)	1 (5)	- (-)	0.1 (.4)	2 (10)	0.1 (1)	2 (7)	0.1 (1)	- (-)	- (-)	- (-)	3 (15)
Gudibanda	8.1	1 (11)	- (-)	- (-)	1 (7)	0.3 (4)	3 (34)	- (-)	- (-)	0.4 (5)	- (-)	0.1 (1)	1 (8)	0.2 (3)	2 (22)	0.1 (1)	- (-)	- (-)	0.1 (1)	0.2 (3)
Gauribidnur	43.6	3 (8)	0.3 (1)	0.1 (0.3)	- (-)	1 (3)	13 (31)	0.1 (0.2)	- (-)	9 (20)	0.4 (1)	0.2 (0.3)	0.2 (0.4)	3 (7)	9 (21)	0.2 (1)	- (-)	- (-)	- (-)	3 (7)
Tumkur																				
Koratgere ½ S	17.6	3 (18)	0.4 (2)	- (-)	- (-)	- (-)	8 (42)	- (-)	- (-)	2 (11)	- (-)	0.1 (.3)	1 (5)	0.1 (1)	3 (14)	1 (4)	- (-)	0.2 (1)	- (-)	0.4 (2)

Annexure 6 contd.

Rainfall Zone - X

Rainfall Pattern D1E3(C3D1)C1E3

District/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Shimoga																				
Bhadravati ½ E	20.4	15 (77)	0.2 (1)	0.1 (1)	- (-	- (-)	1 (8)	- (-)	- (-)	0.1 (0.3)	- (-)	0.1 (0.2)	0.4 (3)	1 (4)	0.4 (2)	0.1 (0.2)	0.1 (1)	0.1 (0.3)	- -	0.2 (1)
Channagiri ½W	45.0	11 (24)	10 (22)	1 (2)	0.1 (.1)	0.1 (.1)	9 (20)	- (-)	- (-)	1 (3)	1 (2)	1 (2)	3 (7)	0.2 (0.4)	2 (4)	0.4 (2)	3 (6)	0.4 (1)	- (-)	3 (4)
Honnali ½ W	29.2	8 (27)	5 (15)	0.4 (2)	- (-)	- (-)	4 (12)	- (-)	- (-)	2 (7)	- (-)	0.4 (2)	3 (10)	0.1 (2)	4 (13)	0.4 (2)	1 (3)	- -	- -	2 (6)
Dharwar																				
Byadgi	34.9	5 (14)	6 (16)	3 (9)	- (-)	- (-)	1 (4)	- (-)	- (-)	3 (9)	- (-)	0.4 (1)	3 (9)	0.1 (0.4)	3 (8)	0.1 (0.3)	4 (12)	- (-)	0.2 (1)	6 (16)
Hirekerur	61.7	11 (17)	5 (8)	5 (9)	- (-)	- (-)	4 (6)	- (-)	- (-)	5 (8)	- (-)	1 (2)	5 (8)	t.3 (0.4)	5 (8)	0.1 (0.2)	10 (17)	- (-)	2 (3)	9 (14)

Annexure 6 (contd.)

Rainfall Zone XI

Rainfall Pattern D1E3(B1C2E1)C1E3

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
N.Kanara																				
Mundgod ½ E	4.7	4 (87)	0.1 (2)	- (-)	- (-)	- (-)	0.1 (2)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (4)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (4)
Shimoga																				
Bhadrawati ½W	20.5	16 (77)	0.2 (1)	0.2 (1)	- (-)	- (-)	2 (8)	- (-)	- (-)	0.1 (1)	- (-)	0.1 (1)	0.4 (2)	1 (4)	0.4 (2)	0.1 (0.2)	0.2 (1)	0.1 (0.4)	- (-)	0.2 (1)
Shikarpur	32.0	21 (66)	- (-)	1 (5)	- (-)	2 (7)	- (-)	- (-)	- (-)	0.2 (1)	02 (1)	- (-)	2 (6)	0.4 (1)	1 (2)	0.1 (0.2)	1 (4)	0.1 (0.2)	- (-)	3 (7)
Shimoga	34.2	22 (65)	1 (2)	- (-)	4 (13)	- (-)	- (-)	- (-)	- (-)	1 (-)	- (-)	- (-)	3 (9)	1 (3)	1 (2)	0.1 (0.2)	- (-)	0.2 (1)	- (-)	2 (4)
Dharwar																				
Hangal	56.0	29 (51)	3 (5)	3 (5)	- (-)	- (-)	2 (3)	- (-)	- (-)	1 (2)	- (-)	0.4 (1)	3 (5)	0.2 (0.3)	2 (4)	0.3 (1)	3 (5)	0.1 (0.1)	8 (14)	3 (5)
Kalghatgi	40.5	21 (52)	4 (1)	1 (2)	0.1 (0.1)	- (-)	1 (2)	- (-)	- (-)	1 (2)	- (-)	0.3 (1)	3 (8)	0.1 (0.4)	0.4 (1)	0.1 (0.2)	2 (4)	- (-)	6 (16)	1 (2)
Hassan																				
Belur	36.9	11 (29)	0.4 (1)	- (-)	- (-)	1 (2)	10 (28)	- (-)	- (-)	- (-)	- (-)	0.1 (0.2)	2 (6)	1 (2)	1 (2)	1 (2)	1 (2)	6 (16)	1 (3)	2 (6)
Alur	17.3	7 (38)	- (-)	- (-)	- (-)	0.1 (1)	5 (27)	- (-)	- (-)	- (-)	- (-)	0.1 (1)	3 (17)	0.1 (1)	- (-)	- (-)	- (-)	2 (14)	- (-)	0.2 (1)
Arkalgud	42.6	5 (13)	0.4 (1)	- (-)	- (-)	0.1 (2)	19 (45)	- (-)	- (-)	0.2 (0.4)	1 (2)	0.1 (0.2)	8 (20)	- (-)	0.3 (1)	0.4 (1)	1 (3)	1 (3)	3 (6)	2 (4)

Annexure 6 (contd.)

Rainfall Zone XII

Rainfall Pattern D1E3(A1B1C2)C1E3

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Shimoga																				
Sorab 2/3 E	20.4	17 (84)	0.1 (1)	- (-)	- (-)	- (-)	1 (3)	- (-)	- (-)	- (-)	0.1 (0.4)	0.1 (1)	1 (4)	0.1 (2)	0.1 (0.4)	- (-)	0.1 (.03)	0.4 (1)	- (-)	1 (4)
N. Kanara																				
Mundgod ½W	4.7	4 (87)	0.1 (2)	- (-)	- (-)	- (-)	0.1 (2)	- (-)	- (-)	0.1 (2)	- (-)	- (-)	0.2 (4)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (4)
Haliyal	17.5	15 (84)	0.2 (1)	- (-)	- (-)	- (-)	0.2 (1)	- (-)	- (-)	0.2 (1)	0.1 (1)	0.1 (1)	1 (8)	0.1 (1)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (2)
Belgaum																				
Belgaum	69.9	19 (27)	4 (6)	- (-)	0.2 (0.3)	- (-)	8 (11)	1 (1)	- (-)	1 (1)	1 (1)	1 (1)	5 (7)	3 (4)	2 (3)	0.4 (1)	1 (1)	- (-)	17 (25)	6 (9)

Annexure 6 (contd.)

Rainfall Zone - XIII

Rainfall Pattern D1E3(A3C1)C1E3

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
N. Kanara																				
Supa	6.2	6 (92)	- (-)	- (-)	- (-)	- (-)	0.1 (2)	- (-)	- (-)	0.1 (2)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	01 (2)	- (-)	0.1 (2)
Yellapur	7.1	5 (74)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	.1 (2)	- (-)	- (-)	- (-)	1 (19)	- (-)	0.4 (5)
Belgaum Khanapur	52.0	25 (47)	1 (1)	- (-)	- (-)	- (-)	4 (7)	- (-)	- (-)	2 (5)	- (-)	- (-)	3 (6)	1 (2)	0.1 (.1)	0.2 (.2)	- (-)	- (-)	15 (29)	1 (2)

Annexure 6 (contd.)

Rainfall Zone - XIV

Rainfall Pattern D1 E2(A3C1)C1D1E2

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Shimoga																				
Sagar ½ E	10.8	8 (74)	- (-)	- (-)	- (-)	- (-)	0.1 (1)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (2)	0.2 (2)	- (-)	- (-)	- (-)	1 (10)	- (-)	1.3 (11)
Tirthahalli 1/3 E	7.0	6 (33)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.1 (1)	- (-)	- (-)	- (-)	1 (14)	- (-)	.1 (2)
Hosanagar ½ E	7.6	7 (89)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (3)	- (-)	- (-)	- (-)	0.4 (5)	- (-)	0.1 (3)
Sorab 1/3 W	10.2	9 (87)	0.1 (1)	- (-)	- (-)	- (-)	0.3 (3)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (2)	- (-)	0.2 (2)	- (-)	- (-)	0.2 (2)	- (-)	.3 (3)
N. Kanara																				
Sirsi	17.2	11 (64)	- (-)	- (-)	- (-)	- (-)	0.1 (1)	- (-)	- (-)	0.1 (1)	- (-)	- (-)	0.3 (2)	0.2 (1)	- (-)	- (-)	- (-)	3 (18)	1 (5)	2 (8)

Annexure 6 (contd.)

Rainfall Zone - XV

Rainfall Pattern D1E3(A2B1)C1E3

district/ taluk	Gca	Pd	Jk	Jr	G	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
N. Kanara																				
Karwar	11.0	9 (84)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (2)	0.1 (1)	- (-)	0.1 (1)	- (-)	1 (8)	0.1 (1)	0.4 (3)

Annexure 6 (contd.)

Rainfall Zone XVI

Rainfall Pattern D1E3(A3B1)C1D1E2

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
N.Kanara																				
Ankola	10.9	7 (63)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (2)	0.2 (2)	0.4 (4)	- (-)	- (-)	1 (9)	- (-)	2 (20)
Shimoga																				
Sagar ½ W	10.8	8 (74)	- (-)	- (-)	- (-)	- (-)	0.1 (1)	- (-)	- (-)	- (-)	- (-)	- (-)	0.1 (2)	0.2 (2)	- (-)	- (-)	- (-)	1 (10)	- (-)	1 (11)
Hosanagar ½ W	7.6	6 (89)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (3)	- (-)	- (-)	- (-)	0.4 (5)	- (-)	0.1 (3)
Tirthahalli 2/3 W	14.1	12 (83)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (1)	- (-)	- (-)	- (-)	2 (15)	- (-)	0.1 (1)
N. Kanara																				
Siddapur	10.8	7 (64)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (2)	- (-)	- (-)	- (-)	3 (24)	- (-)	1 (10)
Chikmagalur																				
Koppa	14.4	7 (48)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (1)	0.1 (1)	- (-)	- (-)	- (-)	7 (48)	- (-)	0.2 (2)
Sringeri	4.8	3 (71)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.1 (2)	- (-)	- (-)	- (-)	1 (25)	- (-)	0.1 (2)
Mudigere	29.4	10 (35)	- (-)	- (-)	- (-)	- (-)	0.1 (0.3)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	18 (61)	- (-)	1 (4)

Annexure 6 (contd.)

Rainfall Zone - XVII

Rainfall Pattern D1E3(A4)C1D1E2

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
N. Kanara																				
Bhatkal	6.3	4 (71)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.1 (2)	- (-)	0.3 (5)	0.1 (2)	0.1 (1)	- (-)	- (-)	1 (15)	- (-)	0.3 (4)
Kumta	10.1	7 (73)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.2 (2)	0.2 (2)	0.4 (4)	- (-)	- (-)	2 (15)	- (-)	0.4 (4)
Honavar	10.5	6 (58)	- (-)	- (-)	- (-)	- (-)	0.1 (1)	- (-)	- (-)	- (-)	- (-)	- (-)	0.3 (3)	0.3 (3)	0.3 (3)	- (-)	- (-)	2 (22)	0.2 (2)	1 (8)

Annexure 6 (contd.)

Rainfall Zone XVIII

Rainfall Pattern D2E2 (A2B1C1)C1D1E2

District/ taluk	Gca	Pd		Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Chikmagalur																					
N. Rajpura	9.2	6 (64)	– (–)	– (–)	– (–)	– (–)	– (–)	– (–)	– (–)	– (–)	– (–)	– (–)	– (–)	0.1 (1)	– (–)	– (–)	0.1 (2)	– (–)	3 (33)	– (–)	– (–)

Annexure 6 (contd.)

Rainfall Zone XIX

Rainfall Pattern C1E3(C1D.E2) C1D1E2

District/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Mandya																				
Maddur	39.4	13 (32)	2 (5)	0.2 (1)	- (-)	0.1 (.2)	10 (25)	- (-)	- (-)	1 (2)	- (-)	0.2 (1)	6 (16)	3 (9)	0.4 (1)	1 (1)	- (-)	1 (2)	0.1 (.3)	2 (5)
Mandya	44.0	11 (26)	1 (3)	0.1 (0.3)	- (-)	0.1 (0.3)	8 (19)	- (-)	- (-)	1 (2)	- (-)	1 (2)	9 (19)	7 (15)	0.3 (1)	1 (2)	- (-)	0.4 (1)	1 (3)	3 (7)
Srirangapatna	29.0	8 (29)	2 (6)	0.4 (2)	- (-)	0.2 (1)	5 (18)	- (-)	- (-)	0.2 (0.4)	- (-)	0.2 (1)	5 (16)	3 (10)	0.4 (1)	1 (2)	- (-)	0.3 (1)	3 (9)	1 (3)
Nagmangla	42.2	3 (8)	1 (2)	0.3 (1)	- (-)	0.4 (1)	19 (44)	- (-)	- (-)	2 (5)	0.1 (0.3)	0.2 (0.4)	11 (25)	0.2 (1)	0.1 (0.3)	1 (2)	- (-)	3 (7)	0.2 (1)	1 (2)
Pandavapura	34.4	4 (12)	1 (2)	- (-)	- (-)	0.2 (1)	12 (34)	- (-)	- (-)	1 (2)	- (-)	1 (2)	7 (21)	3 (10)	1 (3)	1 (2)	- (-)	0.2 (0.3)	2 (5)	2 (6)
Malvalli	49.9	10 (20)	5 (10)	1 (1)	- (-)	0.1 (.2)	14 (29)	- (-)	- (-)	3 (5)	- (-)	1 (2)	6 (11)	0.4 (1)	2 (5)	2 (3)	- (-)	0.2 (1)	1 (1)	5 (11)

Annexure 6 (contd.)

Rainfall Zone - XX

Rainfall Pattern C1E2 (C2D2)C1D1E2

District/ taluk	Gca	Pd	JK	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	Ç	C	L	F	Mc
Bangalore																				
Ramanagram	28.0	1 (5)	– (–)	– (–)	– (–)	1 (3)	15 (55)	– (–)	– (–)	1 (5)	– (–)	1 (3)	3 (10)	1 (2)	1 (3)	1 (3)	– (–)	– (–)	1 (2)	2 (9)
Banglore (S)	34.8	4 (10)	– (–)	– (–)	0.2 (1)	1 (2)	19 (54)	– (–)	– (–)	0.2 (1)	– (–)	0.3 (1)	6 (19)	0.3 (1)	– (–)	1 (2)	– (–)	0.2 (1)	1 (2)	2 (6)
Kanakpura	54.8	3 (5)	– (–)	– (–)	– (–)	0.1 (0.2)	32 (58)	– (–)	– (–)	3 (5)	– (–)	1 (2)	6 (12)	0.4 (1)	3 (6)	2 (3)	– (–)	1 (2)	1 (3)	2 (3)
Anekal	30.1	3 (16)	– (–)	– (–)	– (–)	– (–)	17 (56)	– (–)	– (–)	1 (3)	– (–)	0.1 (0.3)	4 (13)	– (–)	0.3 (1)	1 (3)	– (–)	0.3 (1)	1 (2)	3 (11)
Banglore(N) (1/3)	11.0	1 (9)	– (–)	– (–)	– (–)	0.2 (2)	7 (60)	– (–)	– (–)	0.2 (2)	– (–)	0.1 (1)	1 (9)	0.1 (1)	0.2 (1)	0.1 (1)	– (–)	– (–)	1 (9)	0.4 (5)
Channapatna	31.5	5 (15)	– (–)	– (–)	– (–)	1 (2)	11 (36)	– (–)	– (–)	1 (5)	– (–)	0.4 (1)	3 (10)	0.2 (1)	2 (5)	0.4 (1)	– (–)	3 (9)	1 (3)	4 (12)

Annexure 6 (contd.)

Rainfall Zone XXI Rainfall Pattern C1E3(A4)C1D1E2

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L		Mc
S.Kanara																				
Buntwal	32.6	23 (70)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	1 (4)	- (-)	- (-)	- (-)	- (-)	6 (16)	- (-)	3 (10)
Mangalore	35.6	25 (69)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	1 (4)	0.4 (1)	- (-)	- (-)	- (-)	4 (11)	1 (3)	4 (12)
Udipi	59.8	37 (61)	- (-)	- (-)	- (-)	- (-)	0.2 (0.2)	- (-)	- (-)	- (-)	- (-)	- (-)	3 (5)	1 (1)	0.4 (1)	- (-)	- (-)	6 (10)	- (-)	13 (22)
Coondapur	36.6	27 (73)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	3 (7)	1 (2)	- (-)	- (-)	- (-)	4 (12)	0.2 (1)	2 (5)

Annexure 6 (contd.)

Rainfall Zone XXII　　　　Rainfall Pattern C1E3(A4)B1C1E2

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
S. Kanara																				
Karkal	39.4	30 (76)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	1 (4)	0.1 (0.3)	- (-)	- (-)	- (-)	6 (14)	- (-)	3 (6)
Belthangady	27.7	21 (74)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	1 (3)	- (-)	- (-)	- (-)	- (-)	4 (14)	- (-)	3 (9)
Puttur	24.3	14 (56)	- (-)	- (-)	- (-)	- (-)	0.1 (0.3)	- (-)	- (-)	- (-)	- (-)	- (-)	0.3 (1)	- (-)	- (-)	0.1 (0.3)	- (-)	5 (20)	1 (4)	4 (18)
Sullia	13.7	6 (47)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	6 (45)	- (-)	1 (8)

Annexutre 6 (contd.)

Rainfall Zone XXIII Rainfall Pattern C1D1E2(D2E2)C1D1E2

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Mysore																				
Gundlupet	61.0	1 (2)	21 (34)	- (-)	- (-)	- (-)	6 (10)	- (-)	- (-)	1 (2)	1 (1)	2 (3)	13 (22)	0.1 (0.2)	10 (16)	3 (4)	- (-)	1 (2)	- (-)	3 (4)
Chamarajanagar	66.0	3 (5)	19 (29)	- (-)	- (-)	0.2 (0.3)	6 (8)	- (-)	- (-)	1 (1)	0.2 (0.3)	1 (2)	13 (20)	1 (1)	3 (5)	2 (2)	- (-)	3 (4)	- (-)	15 (23)

Annexure 6 (contd.)

Rainfall Zone XXIV Rainfall Pattern ClDlE2(ClD3)ClDlE2

District/ taluk	Gca	Pad	Jk	Jr	B	M	R	W	Ba	Mt	B	T	Pu	S	Gn	O	C	L	F	Mc
Mysore																				
K.R. Nagar	36.1	14 (38)	1 (3)	- (-)	- (-)	- (-)	8 (22)	- (-)	- (-)	- (-)	0.4 (1)	1 (3)	6 (16)	0.1 (3)	2 (5)	1 (3)	- (-)	1 (3)	- (-)	3 (6)
Nanjangud .	65.1	14 (21)	18 (28)	- (-)	- (-)	- (-)	7 (11)	- (-)	- (-)	2 (3)	0.4 (1)	2 (2)	5 (7)	- (-)	6 (9)	1 (2)	0.4 (1)	1 (2)	- (-)	9 (13)
T.N. Pura	50.6 ( )	12 (23)	8 (16)	- (-)	- (-)	- (-)	8 (16)	- (-)	- (-)	0.4 (1)	1 (1)	1 (1)	7 (14)	1 (2)	1 (3)	0.4 (1)	- (-)	0.1 (0.1)	- (-)	10 (21)
Yelandur	9.5	1 (8)	1 (8)	0.1 (1)	- (-)	0.1 (1)	1 (9)	- (-)	- (-)	- (-)	- (-)	- (-)	1 (6)	0.2 (2)	- (-)	- (-)	- (-)	0.2 (3)	1 (9)	5 (53)
Mysore	63.2	4 (6)	18 (29)	- (-)	- (-)	- (-)	13 (21)	- (-)	- (-)	- (-)	0.1 (0.2)	1 (2)	16 (26)	- (-)	5 (8)	1 (2)	- (-)	1 (2)	0.1 (1)	3 (4)
H.D. Kote	48.3	6 (13)	5 (11)	- (-)	- (-)	- (-)	17 (36)	- (-)	- (-)	0.2 0.4	0.4 (1)	1 (1)	10 (21)	0.1 (0.2)	1 (3)	3 (5)	1 (1)	0.1 (0.2)	- (-)	3 (6)

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Mote : In case of Yelandur taluk about 50% areal under other non-food crops.

Annexure 6 (contd.)

Rainfall Zone - XXIV (contd.) Rainfall Pattern C1D1E2(C1D3)C1D1E2

district/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Mysore																				
Hunsur	45.7	6 (13)	3 (8)	- (-)	- (-)	- (-)	17 (37)	- (-)	- (-)	- (-)	- (-)	1 (2)	8 (17)	- (-)	3 (6)	3 (5)	2 (4)	0.3 (1)	- (-)	3 (6)
P. Patna	41.6	3 (7)	1 (2)	- (-)	- (-)	3 (7)	17 (42)	- (-)	- (-)	- (-)	0.4 (1)	0.4 (1)	8 (20)	- (-)	1 (2)	1 (1)	2 (4)	0.3 (1)	- (-)	5 (12)
Mandya																				
K.R. Pet	44.[illegible]	8 (19)	0.4 (1)	0.1 (0.2)	- (-)	0.2 (0.3)	14 (32)	- (-)	- (-)	1 (2)	- (-)	1 (2)	14 (31)	1 (2)	0.4 (1)	1 (2)	- (-)	2 (5)	0.2 (1)	1 (2)
Hassan																				
Holenarsipur	23.9	5 (20)	0.2 (1)	- (-)	- (-)	0.1 (0.4)	15 (64)	- (-)	- (-)	- (-)	- (-)	- (-)	1 (5)	0.3 (1)	1 (3)	- (-)	- (-)	1 (3)	- (-)	0.4 (2)
Hassan	41.3	7 (18)	0.4 (1)	- (-)	- (-)	1 (2)	19 (46)	- (-)	- (-)	0.1 (0.2)	0.2 (1)	- (-)	6 (15)	1 (2)	1 (2)	0.4 (1)	0.2 (0.4)	1 (3)	- (-)	3 (8)
Mysore																				
Kollegal	55.5	2 (4)	1 (2)	- (-)	1 (2)	0.4 (1)	19 (34)	- (-)	- (-)	4 (7)	- (-)	- (-)	12 (22)	1 (1)	1 (2)	1 (1)	0.1 (0.1)	1 (2)	- (-)	12 (22)
Hassan																				
Arsikere	69.2	1 (2)	5 (7)	1 (1)	- (-)	0.2 (0.2)	35 (50)	- (-)	- (-)	0.2 (0.2)	0.3 (1)	0.3 (1)	5 (7)	- (-)	1 (1)	3 (5)	2 (2)	13 (18)	3 (4)	1 (1)
C. Patna	65.0	5 (8)	1 (2)	- (-)	- (-)	0.1 (0.1)	24 (36)	- (-)	- (-)	2 (3)	0.4 (1)	1 (1)	12 (19)	1 (2)	1 (1)	1 (2)	- (-)	12 (18)	3 (5)	2 (2)
Tumkur																				
Tiptur	15.0	1 (8)	0.4 (4)	- (-)	- (-)	- (-)	5 (30)	- (-)	- (-)	0.2 (1)	- (-)	0.1 (1)	2 (12)	- (-)	0.1 (0.4)	0.2 (1)	- (-)	6 (40)	0.2 (1)	0.2 (1)

Annexure 6 (contd.)

Rainfall Zone - XXV Rainfall Pattern C1D1E2(A3C1)C1D1E2

District/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Coorg																				
Virajpet ½E	25.7	12 (45)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	10 (39)	- (-)	4 (16)
Somvarpet	42.1	12 (28)	- (-)	- (-)	- (-)	0.4 (1)	4 (9)	- (-)	- (-)	- (-)	1 (2)	- (-)	3 (7)	- (-)	0.4 (1)	0.1 (.2)	0.2 (.4)	19 (45)	- (-)	3 (6)
Hassan																				
Sakleshpur	41.0	13 (31)	- (-)	- (-)	- (-)	0.2 (1)	0.2 (1)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	27 (66)	0.3 (1)	- (-)
Chikmagalur																				
Chikmagalur ½ W	25.8	6 (24)	1 (4)	0.1 (.2)	- (-)	0.1 (.1)	4 (15)	- (-)	- (-)	- (-)	- (-)	- (-)	1 (4)	0.2 (1)	0.4 (2)	1 (3)	- (-)	11 (42)	- (-)	1 (5)

Annexure 6 (contd.)

Rainfall Zone - XXVI

Rainfall Pettern C1D1E2(A4)C1D1E2

District/ taluk	Gca	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Mc
Coorg																				
Virajpet ½W	25.8	11 (43)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	11 (42)	- (-)	4 (15)
Mercara	33.1	11 (34)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	0.1 (0.3)	- (-)	19 (57)	- (-)	3 (9)

Annexure 7

Statement .I: Districtwise List of Rainfall, Cropping and Livestock Patterns

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
BANGALORE dt.			
Hoskote	D1 E3 (C1 D3) C1 D1 E2	R2 Pu4/Pd4 Pu4/Pd4/Pu4 Pd5/Pu4 M4	S3 Cms Cf4 G4/ Cy4/Bf4
Devananhalli	D1 E3 (C2 D2)C1 D1 E2		
Doddballapur			
Magadi			Cf3 S4 Cy4/G4/Cm4
Melamangala			
Bangalore North ½N			
Bangalore North ½ S	C1 E3 (C2 E2)C1 D1 E2		
Kanakpura			
Ramanagaram			
Bangalore South			S3 Cm4 Cf4 G4/Cy4/Bf4
Anekal			
Channapatna		R3 Pd4 Pu4 Jk4/L4	S4 Cm4 Cf4 G4/ Bf4/Cy4

Annexure 7 (contd), Statement 1 (contd)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
BELGAUM dt.			
Athani	D1 E3 (C1 D3)D1 E3	Jr4 B4 Jk4 Gn4	G4 S4 Cm4 Cf4/Cy4/ Cy4 Bf4
Ramdurg		Jr4 B4 Jk4 Gn4/M4/W4	S4 G4 Cm4 Cf4/Bf4
Gokak			
Saundatti		Jk4 C4 Gn4 W4/Pu4 Pd4 Jr4	
Raibag		B4 Jk4 M4 Pu4 Gn4	
Chikodi		Gn4 Jk4 To4 S5	S3 G4 Cm4/Bf4
Hukeri	D1 E3 (C2 D2)C1 E3		S4 G4 Cm4 Cf4/Bf4
Bailhongal		Jk4 C4 Gn4 W4/ Pu4 Pd4 Jr 4	Bf4 Cm4 By4 Cf4
Belgaum	D1 E3 (A1 B1 C2)C1 E3	Pd4 R4 F4 Jk5	
Khanapur	D1 E3 (A3 C1) C1 E3	Pd2 L4/B4/M5/V4/F4	Cm3 Cf4 Cy4
BELLARY dt.			
Kudligi	D1 E3 (C1 D3) D1 E3	Jk4 Mt4 B4 Gn4/C4/C4 Pu4	S3 G4 Cm4/Cf4
Sandhur			S4 Cm4 Cf4 G4/Bf4/Cy4
Harpanahalli		Jk4 C4 Gn4 R4/Pu4	
Hadagalli		Gn3 Jk4 C4/W4/Pu4	
Mallapuram			
Hospet		C4 Jk4 Pu4 Mt4 Gn4/ S4/Pd4	
Siruguppa		C3 Jr4 Mt4/Pd5	
Bellary			Cm4 Cf4 S4 G4

Annexure 7 (Contd), Statement 2 (Contd...)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
BIDAR dt.			
Bidar	E4 (B1 C3) D1 E3	Jr3 G4 Pu4 Jk5	Cm4 Cf4 Cy4 G4/S4/Bf4
Basava Kalyan		Pu4 Mt4 O4 B4 Jr4	
Humnabad		Pu4 T4 Jr4 Gn4 O4/Jk4	
Bhalki		Pu4G4 Jk4 Jr4/ Jr5Mt5 Gn5	
Aurad			Cy3 Cf4 Cm4 S4
BIJAPUR dt.			
Bagevadi	E4 (C1 D3) D1 E3	Jr3 B4 Gn4/C4	G4 S4 Gm4 Cf4/Cy4/Cy4 Bf4
Bijapur			
Bilgi			
Indi			
Sindgi			
Modhol			S4 G4 Cm4 Cf4/Bf4
Jamkhandi			
Badami		Gn4 Jr4 Jk4 B4/W4	
Bagalkot		C4 Jr4 Jk4 Mt4/Gn4/ Gn4 Pu4/B4/B4/Mt4	
Hungund			G4 S4 Cm4 Cf4/Cy4/Cy4 Bf4
Muddebihal			

Annexure 7 (contd), Statement 1 (contd)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
CHIKMAGALUR dt.			
Kadur	D1 E3 (C1 D3) C1 D1 E2	R4 L4 Pu4 Mt4 Jk4/P d4/ Mt4 Jk4	S4 Cm4 Cf4 G4/Cy4
Tarikere			Cm4 Cf4 Cy 4 S4/G4/Bf4
Chikmagalur ½ E		L3 Pd3	Cf3 Cy4 Cm4/Bm4
Koppa	D1 E3 (A3 B1) C1 D1 E2		
Sringeri			
Mudigere		L2 Pd3	Cm4 Cf4 Cy4/P4
N.R. Pura	D2 E2 (A2 E1 C1) C1 D1 E2	Pd2 L4/B4/M5/V4/F4	Cf3 Cy4 Cm4/Bm4
Chikmagalur ½W	C1 D1 E2 (A3 C1) C1 D1 E2	L 3 Pd3	

Annexure 7 (contd), Statement 1 (contd.)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
CHITRADURGA dt.			
Hiriyur	D1 E3 (D2 E2) C1 D1 E2	C4 Mt4 Jr4 Jk4 Pu4	S3 G4 Cm4/Cf4
Challakere		Pu4 Jk4 Mt4 B4/Gn4/ R4 Gn4	
Molakalmuru ½N Malakalmuru ½S	D1 E3 (C1 D3) D1 E3 D1 E3 (C1 D3) C1 D1 E2	Jk4 Mt4 B4 Gn4/C4/ C4 Pu4	
Hosadurga		R4 L4 Pu4 Mt4/Jk4/Pd4/ Mt4 Jk4	
Holakere			S4 Cm4 Cf4 G4/Bf4/Cy4
Jagalur		Mt4 R4 Jk4 Pu4	
Chittradurga			
Davangere		Pd4 R4 Jk4 Gn4/Pu4	Cm4 Cf4 Cy4 S4/G4/Bf4
Harihar			
COORG dt.			
Somwarpet	C1 D1 E2(A3 C1) C1 D1 E2	L3 Pd3	Cf3 Cy4 Cm4/Bm4
Virajpet ½ E			Cm4 Cf4 Cy4/P4
Virajpet ½ W	C1 D1 E2 (A4) C1 D1 E2		
Mercara		L2 Pd3	

Annexure 7 (contd), Statement 1 (contd)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
[illegible] Dt.			
Ron	D1 E3(C1 D3) D1 E3	Gn4 Jr4 Jk4 B4/W4	S4 G4 Cm4 Cf4/Bf4
Gadag		Gn3 Jk4 C4/W4/Pu4	
Mundargi			
Navalgund		W3 C4 Jk4/Jr4	Cm4 Cf4 Cy4 S4/G4/Bf4
Nargund		C3 W4 Jr4	G4 S4 Cm4
Ranebennur	D1 E3 (C1 D3) C1 D1 E2	C3 Jk4 Mt4	S3 G4 Cm4
Kundagol	D1 E3 (C2 D2) C1 E3	C4Jk4 Gn4	Cm4 Cf4 Cy4 S4/G4/Bf4
Savanur			
Shirahatti		Gn3 Jk4 C4/W4/Pu4	
Dharwar		Jk4 C4 Gn4 W4/Pu4 Pd4 Jr4	
Hubli			
Haveri		Jk4 C4 Gn4 R4/Pu4	
Shiggaon		Pd4 C4 Gn4 Pu4	
Byadgi	D1 E3(C3 D1) C1 E3	Pd4 C4 Jk4 Mt4 Ch4	
Hirekerur			
Hangal	D1 E3 (B1 C2 E1) C1 E3	Pd2 L4/B4/M5/V4/F4	
Kalghatgi			Cm3 Cf4 Cy4

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
GULBARGA dt.			
Shahapur	E4 (C3 D1) D1 E3	C4 Jr4 Jk4 Mt4/ Gn4/Gn4 Pu4,'B4/B4 Mt4	S4 Cm4 Cf4 G4/Bf4/Cy4
Shorapur			
Yadgir		Jr4 Mt4 Gn4 Pu4	
Jevargi	E4(C4) D1 E3	Jr3 O4 Gn4 T4/C4/T4B4	
Sedam		Jr3 O4 T4	Cm4 Cf4 Cy4 G4/S4/Bf4
Gulbarga		Jr3 O4 Gn4 T4/C4/ T4 B4	
Chitapur			
Afzalpur			
Aland			
Chincholi		Pu4 T4 Jr4 Gn4 O4/Jk4	

Annexure 7 (contd)
Statement 1 (contd)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
HASSAN dt.			
Alur	D1 E3 (B1 C2 E1) C1 E3	Pd3 R4 L4/Pu4	Cf3 Cy4 Cm4/Bm4
Belur			
Arkalgud		R3 Pu4 Pd4/L4	
Hassan	C1 D1 E2 (C1 D3) C1 D1 E2		S4 Cm4 Cf4 G4/Cy4
Arsikere			
Channarayapatna			S3 G4 Cm4/Cf4
Holenarsipur		R2 Pu4/Pd4/Pu4 Pd4/Pu4 Pd5/ Pu4 M4	
Saklespur	C1 D1 E2 (A3 C1) C1 D1 E2	L2 Pd3	Cm4 Cf4 Cy4/P4

Annexure 7 (contd)
Statement 1 (contd)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
KOLAR dt.			
Bagepalli	D1 E3 (C1 D3) C1 D1 E2	Gn3 B4 R4	S3 G4 Cf4/Cm4
Srinivaspur		R3 Gn4 Pd4/Mt4/Pu4/Pu4 Pd4	S4 Cm4 Cf4 G4
Bangarpet			S3 G4 Cf4/Cm4
Chintamani			
Mulbagal			
Kolar		R2 Pu4/Pd4/Pu4 Pd4/Pu4 Pd5/ Pu4 M4	
Malur			
Chikballapur	D1 E3 (C2 D?) C1 D1 E2		S3 Cm4 Cf4 G4/Cy4/Bf4
Gauribidanur		R3 Gn4 Pd4/Mt4/Pu4/Pu4 Pd4	
Gudibanda			
Sidalghata			S3 G4 Cf4/Cm4

Annexure 7 (contd)
Statement 1 (contd)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
MANDYA dt.			
Mandya	C1 E3 (C1 D1 E2) C1 D1 E2	Pd4 R4 Pu4 S4/Jk4	S3 G4 Cm4/Cf4
Maddur			S4 Cm4 Cf4 G4/Bf4/Cy4
Srirangapatna			
Malavalli		R3 Pd4 Pu4 L4/Jk4	
Nagamangala		R3 Pu4 Pd4/L4	S3 G4 Cm4/Cf4
Pandavapura			
K. R. Pet	C1 D1 E2 (C1 D3) C1 D1 E2		

Annexure 7 (contd)
Statement 1 (contd)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
MYSORE dt.			
Chamrajnagar	C1 D1 E2 (D2 E2) C1 D1 E2	Jk4 Pu4 R4 Pd4/Gn5 Pd5	S4 Cm4 Cf4 G4/Bf4/Cy4
Gundlupet		Jk3 Pu4 R4/Gn4	
Mysore	C1 D1 E2 (C1 D3) C1 D1 E2		
Nanjangud		Jk4 Pu4 R4 Pd4/Gn5 Pd5	Cm4 Cf4 Cy4/P4
K. R. Nagar		Pd4 R4 L4/Pu4	Cf4 Cm4 Cy4 S4/G4
T. Narsipur		Pd4 R4 Pu4 S4/Jk4	S4 Cm4 Cf4 G4/Bf4/Cy4
Yelandur		Nf2 Pd4 R4	
Hunsur		R3 Pu4 Pd4/L4	Cf4 Cm4 Cy4 S4/G4
H. D. Kote			Cm4 Cf4 Cy4/P4
Periyapatna			Cf3 Cy4 Cm4/Bm4
Kollegal		R3 Pu4 Nf4	Cf3 S4 Cy4/G4/Cm4

Statement 1 (contd)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
NORTH KANARA dt.			
Mundgod ½E	D1 E3 (B1 C2 E1) C1 E3	Pd1	Cm3 Cf4 Cy4
Mundgod ½W	D1 E3 (A1 B1 C2) C1 E3		
Haliyal			
Supa	D1 E3 (A3 C1) C1 E3		Cf4 Cy4 Cm4/Cm4 Bf4
Yellapur			
Sirsi	D1 E3 (A3 C1) C1 D1 E2	Pd2 L4/B4/M5/V4/F4	Cm4 Cf4 Cy4
Karwar	D1 E3 (A3 B1) C1 E3	Pd1	Cm3 Cf4 Cy4
Ankola	D1 E3 (A3 B1) C1 D1 E2	Pd2 L4/B4/M5/V4/F4	
Siddapur			Cm4 Cf4 Cy4
Honawar	D1 E3 (A4) C1 D1 E2		Cf3 Cy4 Cm4/Bm4
Bhatkal		Pd1	
Kumta			Cm4 Cf4 Cy4

Annexure 7 (contd)
Statement 1 (contd)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
RAICHUR dt.			
Kushtagi	D1 E3 (C1 D3) D1 E3	Pu4 Gn4 Mt4 Jk4 W4 C4	Cm4 Cf4 S4 G4
Sindhanur		C3 Jr4 Mt4/Pd5	S4 Cm4 Cf4 G4/Bf4/Cy4
Gangavathi		C4 Jk4 Pu4 Mt4 Gn4/S4/Pd4	Cm4 Cf4 S4 G4
Koppal			
Yelburga			
Lingsugur 2/3 W	E4 (C1 D3) D1 E3	C4 Jr4 Jk4 Mt4/Gn4/Gn4 Pu4/B4/ B4 Mt4	S4 Cm4 Cf4 G4/Bf4/Cy4
Lingsugur	1/3E E4 (C3 D1) D1 E3		
Raichur			
Deodurg			
Manvi		C3 Jr4 Mt4/Pd5	

Annexure 7 (contd)
Statement 1 (contd)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
SHIMOGA dt.			
Channagiri ½E	D1 E3 (C1 D3) C1 D1 E2	Pd4 R4 Jk4 Gn4/Pu4	Cm4 Cf4 Cy4 S4/G4/Bf4
Honnali ½E			
Honnali ½W	D1 E3 (C3 D1) C1 E3		
Channagiri ½W			
Bhadravati ½E		Pd1	Cm4 Cf4 Cy4
Bhadravati ½W	D1 E3 (B1 C2 E1) C1 E3		
Shikarpur		Pd2 L4/B4/M5/V4/F4	
Shimoga			
Sorab 2/3E	D1 E3 (A1 B1 C2) C1 E3	Pd1	
Sorab 1/3W	D1 E3 (A3 C1) C1 D1 E2		
Sagar ½E			
Hosanagar ½E			Cf3 Cy4 Cm4/Bm4
Tirthahalli 1/3E			
Tirthahalli 2/3W	D1 E3 (A3 B1) C1 D1 E2		
Hosanagar ½W			
Sagar ½W			Cm4 Cf4 Cy4

Statement 1 (contd)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
SOUTH KANARA dt.			
Coondapur	B1 E3 (A4) C1 D1 E2	Pd1	Cf3 Cy4 Cm4/Bm4
Buntwal			Cf4 Cy4 Cm4/Cm4 Bm4
Mangalore			
Udipi			
Karkal	C1 E3 (A4) B1 C1 E2		
Beltangady			Cm4 Cf4 Cy4/P4
Puttur		Pd2 L4/B4/M5/V4/F4	
Suliya			

Annexure 7 (contd)
Statement 1 (contd)

Taluks	Rainfall Patterns	Cropping Patterns	Livestock Patterns
TUMKUR dt.			
Pavagada	D1 E3 (C1 D3) C1 D1 E2	Pu4 Jk4 Mt4 G4/Gn4/R4 Gn4	S3 G4 Cm4/Cf4
Sira			
C. N. Halli		R3 Pu4 Pd4/L4	
Madhugiri		R3 Gn4 Pd4/Mt4/Pu4/Pu4 Pd4	
Koratgere ½N			S3 Cm4 Cf4 G4/Cy4/Bf4
Koratgere ½S	D1 E3 (C2 D2) C1 D1 E2		
Tumkur		R2 Pu4/Pd4/Pu4 Pd4/$\overset{\text{Pu4}}{\text{Pd5}}$/Pu4 M4	
Kunigal			S3 G4 Cm4/Cf4
Turuvekere		R3 Pu4 Pd4/L4	
Gubbi			
Tiptur ½E			
Tiptur ½W	C1 D1 E2 (C1 D3) C1 D1 E2		

Statement II : Rainfall, Cropping and Livestock Patterns in each Zone with area under Forests and Irrigation

Zone No.	area (sq km)	forests		rainfal patterns, district*/taluk	Normal annual rainfall (cm)	gross cropped area		net area sown ('000 ha)	net irrigated area			cropping patterns	livestock patterns
		area ('000 ha)	% of zonal area			area ('000 ha)	% of zonal area		area ('000 ha)	% of total irrigated area in State	% of net area sown in zone		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
I	18,422	86.0	4.7	E4(C1D3)D1E3 **Bijapur**: Bijapur, Bagewadi, Jamkhandi, Bilgi, Mudhol, Indi, Sindgi, Muddebihal, Hungund, Bagalkot, Badami **Raichur**: Lingsugur (2/3W)	55	1532	83.0	1511	49.9	4.4	3.3	Jr3 B4 Gn4/C4 Gn4 Jr4 Jk4 B4/W4 C4 Jr4 Jk4 Mt4/Gn4/Gn4 Pu4/B4 B4 Mt4	G4 S4 Cm4 Cf4/Cy4/Cy4 Bf4 S4 G4 Cm4 Cf4/Bf4 S4 Cm4 Cf4 G4/Bf4/Cy4 G4 S4 Cm4 Cf4/Cy4/Cy4 Bf4

* districts are underlined

Annexure 7 contd....

1	2	3	4	5	6	7	8	9	10	11	12	13	14
II	10,496	41.4	3.9	E4(C3D1)D1E3	66	783	74.6	763	47.3	4.1	6.2	C3 Jr4 Mt4/Pd5	S4 Cm4 Cf4 G4/Bf4/Cy4
				Raichur: Raichur, Deodurg, Manvi, Lingsugur(1/3E)								C4 Jr4 Jk4 Mt4/Gn4/Gn4Pu4/ B4 B4Mt4	
				Gulburga: Shorapur, Yadgir, Shahapur								Jr4 Mt4 Gn4 Pu4	
III	10,892	37.2	3.4	E4(C4)D1E3	77	856	78.6	833	13.3	1.2	1.6	Jr3 04 T4	Cm4 Cf4 Cy4 G4/S4/Bf4
				Gulburga: Aland, Gulburga, Afzalpur, Jevargi, Sedam, Chitapur, Chincholi								Jr3 04 Gn4 T4/C4/T4 B4	S4 Cm4 Cf4 G4/Bf4/Cy4
												Pu4 T4 Jr4 Gn4 04/Jk4	
IV	5,451	10.0	1.9	E4(B1C3)D1E3	82	407	74.7	335	11.8	1.0	3.5	Jr3 G4 Pu4 Jk5 Pu4 Mt4 04 B4 Jr4	Cy3 Cf4 Cm4 S4 Cm4 Cf4 Cy4 G4/S4/Bf4
				Bidar: Bidar, Aurad, Bhelki, B Kalyan, Humnabad								Pu4 T4 Jr4 Gn4 04/Jk4	
												Pu4 G4 Jk4 Jr4/Jr5 Mt5 Gn5	
V	3,763	19.0	5.0	D1E3(D2E2)C1D1E2	50	134	35.6	125	17.6	1.5	14.1	C4 Mt4 Jr4 Jk4 Pu4	S3 Gn4/Cf4
				Chitradurga: Hiriyur, Challakere								Pu4 Jk4 Mt4 B4/Gn4/R4 Gn4	

Annexure 7 (contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
VI	30,427	214.4	7.0	D1E3(C1D3)D1 E3	60	2,286	75.1	2,235	173.3	15.2	7.8	C3 W4 Jr4	S3 G4 Cm4/Cf4
				Bellary: Bellary, Siruguppa, Sandur, Kudligi, Harpanhalli, Hospet, Malapuram, Hadagalli								C2 Jr4 Mt4/ Pd5	S3 G4 Cm4/Bf4
												C4 Jk4 Pu4 Mt4 Gm4 S4/ Pd4	S4 G4 Cm4 Cf4/ Bf4
				Raichur: Sindhanur, Koppal, Kushtagi, Yelburga, Gangawati								W3 C4 Jk4/ Jr4	S4 Cm4 Cf4 G4/ Bf4/Cy4
												Gn3 Jk4 C4/ W4/Pu4	G4 S4 Cm4
				Dharwar: Nargund, Navalgund, Gadag, Ron, Mundargi								Gn4 Jr4 Jk4 B4/W4	G4 S4 Cm4 Cf4/ Cy4/Cy4 Bf4
				Belgaum: Saundatti, Gokak, Ramdurg, Athni, Raibag, Chikodi								Gn4 Jk4 To4 S5	Cm4 Cf4 S4 G4
												Jk4 C4 Gn4 R4/Pu4	Cm4 Cf4 Cy4 S4/G4/Bf4
				Chitradurga: Malakalmuru (1/2 N)								Jk4 C4 Gn4 W4/Pu4 Pd4 Jr4	
												Jk4 Mt4 B4 Gn4/ C4/C4 Pu4	
												Jr4 B4 Jk4 Gn4	
												Jr4 B4 Jk4 Gn4/ M4/W4	
												B4 Jk4 M4 Pu4 Gn4	
												Pu4 Gn4 Mt4 Jk4 W4 C4	

1	2	3	4	5	6	7	8	9	10	11	12	13	14
VII	24,063	231.0	9.6	D1E3(C1D3)C1D1E2	68	1,139	47.3	1,355	171.0	15.0	15.9	L3 Pd3	S3 G4 Cm4/Cf4
				Chitradurga: Devangere, Harihar, Jagalur, Holalkere, Molakalmuru(½ S), Chitradurga, Hosdurga								R2 Pu4/Pd4/ Pu4 Pd4/Pu4 Pd5/Pu4 M4	S3 G4 Cm4
												R3 Pu4 Pd4/ L4	S3 Cm4 Cf4 G4/ Cy4/Bf4
				Shimoga: Honnali (½E), Channagiri (½E),								R3 Gm4 Pd4/ Mt4/Pu4/Pu4 Pd4	S4 Cm4 Cf4 G4/ Cy4
				Kolar: Kolar, Malur, Bangerpet, Srinivaspur, Mulbagal, Chintamani, Bagepalli,								R4 L4 Pu4 Mt4/ Jk4/Pd4/Mt4 Jk4	S4 Cm4 Cf4 G4/Bf4/Cy4
												C3 Jk4 Mt4	S4 Cm4 Cf4 G4
				Bangalore: Hoskote								Gn3 B4 R4	Cf3 Cy4 Cm4/ Bm4
				Tumkur: CN Hally, Sira, Pavgada, Koratgere(½N), Madhugiri								Pd4 R4 Jk4 Gn4/Pu4	Cm4 Cf4 Cy4 S4/G4/Bf4
												Jk4 Mt4 B4 Gn4/C4/C4 Pu4	
				Chikmagalur: Kadur, Tarikere, Chikmagalur (½E)								Mt4 R4 Jk4 Pu4	
												Pu4 Jk4 Mt4 B4/ Gn4/R4/Gn4	
				Dharwar: Ranebennur									

Annexure 7 (contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
VIII	7,499	64.0	8.5	D1E3(C2D2)C1E3 Dharwar: Shiggaon, Dharwar, Hubli, Kundgol, Haveri, Savanur, Shirhatti Belgaum: Bailhongal, Hukeri	72	616	82.1	598	30.6	2.7	5.1	Gn3 Jk4 C4/ W4/Pu4	Cm4 Cf4 Cy4 S4/G4/Bf4
												Gn4 Jk4 To4 S5	Bf4 Cm4 By4 Cf4
												Jk4 C4 Gn4 R4/Pu4	S4 G4 Cm4 Cf4/Bf4
												Jk4 C4 Gn4 W4/Pu4 Pd4 Jr4	
												C4 Jk4 Gn4	
												Pd4 C4 Gn4 Pu4	
IX	10,252	63.0	6.4	D1E3(C2D2)C1D1E2 Bangalore: Magadi, Devanhalli, Nelmangla, Dodballapur, Bangalore-N(½N) Tumkur: Tumkur, Kunigal, Gubbi, Turuvekere, Tiptur (½E), Koratgere(½S) Kolar: Chikballapur, Siddlaghata, Gudibanda, Gauribidnur	75	491	47.8	471	89.7	7.8	19.0	R2 Pu4/Pd4/ Pu4 Pd4/Pu4 Pd5/Pu4 M4	Cf3 S4 Cy4/ G4/Cm4
												R3 Pu4 Pd4/ L4	S3 Cm4 Cf4 G4/Cy4/Bf4
												R3 Gn4 Pd4/ Mt4/Pu4/ Pu4 Pd4	S3 G4 Cm4/Cf4

Annexure 7 (contd.)

2	3	4	5	6	7	8	9	10	11	12	13	14
2,641	29.0	10.8	D1E3(C3D1)C1E3 **Shimoga:** Bhadrawati(½E), Honnal[illegible] (½W), Channagiri (½W) **Dharwar:** Byadgi, Hirekerur	73	190	71.9	172	35.2	3.1	20.5	Pd1 Pd4 R4 Jk4 Gn4/Pu4 Pd4 C4 Jk4 Mt4 Ch4	Cm4 Cf4 Cy4 Cm4 Cf4 Cy4 S4/G4/Bf4
6,078	91.3	15.0	D1E3(B1C2E1)C1[illegible] **N.Kanara:** Mundgod(½E), **Shimoga:** Bhadrawati(½W), Shimoga, Shikarp[illegible] **Dharwar:** Hangal, Kalaghatgi **Hassan:** Belur, Alur, Arkalgud	[illegible]7	284	46.7	258	108.8	9.5	42.3	Pd1 Pd2 L4/B4/V4/ M5/F4 Pd3 R4 L4/Pu4 R3 Pu4 Pd4/L4	Cm3 Cf4 Cy4 Cm4 Cf4 Cy4 Cm4 Cf4 Cy4 S4/G4/Bf4 Cf3 Cy4 Cm4 Bm4
2,985	126.0	42.2	D1E3(A1B1C2)C1E[illegible] **Shimoga:** Sorab (2/3E) **N.Kanara:** Mundgo[illegible] (½W), Haliyal **Belgaum:** Belgau[illegible]	132	112	37.5	107	21.3	1.9	19.9	Pd1 Pd4 R4 F4 Jk5	Cm3 Cf4 Cy4 Cm4 Cf4 Cy4 Bf4 Cm4 By4 Cf4

1	2	3	4	5	6	7	8	9	10	11	12	13	14
[illegible]	4,914	389.0	78.6	D1E3(A3C1)C1E3	217	65	13.2	65	6.1	0.5	9.4	Pd1	Cf4 Cy4 Cm4/ Cm4 Bf4
				N.Kanara: Supa, Yellapur,								Pd2 L4/B4/M5/ V4/F4	Cm3 Cf4 Cy4
				Belgaum: Khanapur									
IV	3,813	167.0	43.8	D1E3(A3C1)C1D1E2	240	53	13.9	55	27.1	2.4	49.3	Pd1	Cf3 Cy4 Cm4/ Bm4
				Shimoga: Sagar(½E), Sorab(1/3W), Tirthahalli(1/3E), Hosnagar(½E)								Pd2 L4/34/M5/ V4/F4	Cm4 Cf4 Cy4
				N.Kanara: Sirsi									
V	732	55.0	75.2	D1E3(A3B1)C1E3	307	11	15.0	10	0.6	0.1	6.1	Pd1	Cm3 Cf4 Cy4
				N.Kanara: Karwar									
VI	6,492	252.0	39.7	D1E3(A3B1)C1D1E2	290	103	15.9	104	24.0	2.1	23.1	Pd1	Cm3 Cf4 Cy4
				N.Kanara: Ankola, Siddapur								Pd2 L4/B4/M5/ V4/F4	Cm4 Cf4 Cy4
				Shimoga: Sagar(½W) Hosnagar(½W), Tirthahalli(2/3W)								L2 Pd3	Cm4 Cf4 Cy4/ F4
												L3 Pd3	Cf3 Cy4 Cm4/ Bm4
				Chikmagalur: Koppa, Sringere, Mudigere									
VII	1,687	123.0	72.9	D1E3(A4)C1D1E2	369	27	16.0	23	4.6	0.4	20.0	Pd1	Cf3 Cy4 Cm4/ Bm4
				N.Kanara: Bhatkal, Kumta, Honavar								Pd2 L4/B4/M5/ V4/F4	Cm4 Cf4 Cy4

1	2	3	4	5	6	7	8	9	10	11	12	13	14
II	814	31.0	38.6	D2B2(A2B1C1)C1D1E2 Chikmagalur: N.Rajpura	182	9	11.1	9	0.5	Neg.	4.9	Pd2 L4/34/V4/ M5/F4	Cf3 Cy4 Cm4/ Bm4
X	4,066	19.0	4.7	C1E3(C1D1E2)C1D1E2 Mandya: Maddur, Mandya, Srirangapatna, Nagmangla Malvalli, Pandvapura	68	239	58.8	217	72.1	6.3	33.2	R3 Pd4 Pu4 L4/ Jk4 R3 Pu4 Pd4/ L4 Pd4 R4 Pu4 34/Jk4	S3 G4 Cm4/ Cf4 S4 Cm4 Cf4 G4/Bf4/Cy4
[illegible]	4,021	63.3	15.8	C1E3(C2D2)C1D1E2 Bangalore: Ramanagaram, Bangalore-S, Kanakpura, Anekal, Bangalore-N(½S), Channapatna	85	190	47.2	186	33.7	3.0	18.0	R2 Pu4/Pd4/Pu4 Pd4/Pu4 Pd5/ Pu4 M4 R3 Pd4 Pu4 L4/ Jk4	S3 Cm4 Cf4 G4/Cy4/Bf4 S4 Cm4 Cf4 G4/Bf4/Cy4 Cf3 S4 Cy4/ G4/Cm4
I	3,758	77.0	20.5	C1E3(A4)C1D1E2 S.Kanara: Bantwal, Mangalore, Udipi, Coondapur	365	165	43.9	114	41.4	3.6	36.3	Pd1	Cf3 Cy4 Cm4/ Bm4 Cf4 Cy4 Cm4/ Cm4 Bm4
[illegible]	4,623	169.0	36.5	C1E3(A4)B1C1E2 S.Kanara: Karkal, Puttur, Belthangadi, Suliya	438	105	22.7	75	34.2	3.0	45.6	Pd1 Pd2 L4/34/M5/ V4/F4	Cf4 Cy4 Cm4/ Cm4 Bm4 Cm4 Cf4 Cy4/ F4

Annexure 7 (contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
XXIII	2,637	75.0	28.3	C1D1E2(D2E2)C1D1E2	68	127	48.2	101	5.8	0.5	5.8	Jk3 Pu4 R4/Gn4	S4 Cm4 Cf4 G4/Bf4/Cy4
				Mysore: Gundlupet, Chamrajnagar								Jk4 Pu4 R4 Pd4/Gn5 Pd5	
XXIV	14,806	265.0	17.9	C1D1E2(C1D3)C1D1E2	75	673	45.7	600	97.4	8.5	16.2	R2 Pd4	S3 G4 Cm4/Cf4
				Mysore: KR Nagar, Nanjangud, TN Pura, Yelandur, Mysore, HD Kote, Hunsur, P Patna, Kollegal								R3 Pu4 Nf4 R3 Pu4 Pd4/L4 Nf2 Pd4 R4	S4 Cm4 Cf4 G4/Cy4 S4 Cm4 Cf4 G4/Bf4/Cy4 Cf3 Cy4 Cm4/Bm4
				Mandya KR Pet								Jk3 Pu4 R4/Gn4	Cf3 S4 Cy4/G4/Cm4
				Hassan: Holenarsipur, Hassan, Arsikere, C Patna								Jk4 Pu4 R4 Pd4/Gn5 Pd5	Cf4 Cm4 Cy4 S4/G4
				Tumkur: Tiptur (½W)								Pd4 R4 Pu4/L4 Pd4 R4 Pu4 S4/Jk4	Cm4 Cf4 Cy4/P4
XXV	3,705	90.0	24.3	C1D1E2(A3C1)C1D1E2	203	135	36.4	127	22.5	2.0	17.7	L2 Pd3	Cf3 Cy4 Cm4/Bm4
				Coorg: Virajpet(½E), Somvarpet								L3 Pd3	Cm4 Cf4 Cy4/P4
				Hassan: Sakleshpur									
				Chikmagalur: Chikmagalur (½W)									

Annexure 7 (contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
XXVI	2,279	82.0	35.9	C1D1E2(A4)C1D1E2	297	59	25.9	55	2.4	0.2	4.3	L3 Fd3	Cm4 Cf4 Cy4/F4
				Coorg: Virajpet (½W), Mercara								L2 Fd3	
	1,91,343	2,875.6	15.0			10,794	56.4	10,204	1,142.2		11.2		

ANNEXURE 8

(Rainfall and Cropping Patterns, Karnataka)

This annexure contains the following large size maps on 1 : 1 M scale:-

MAP	I	Rainfall Patterns
MAP	II	Month of Maximum Rainfall together with Rainfall Amount and Rainy Days of Two Consecutive Months including the Month of Maximum
MAP	III	Cropping Patterns
MAP	IV	Livestock Patterns
MAP	V	Soils

5 large sized sheets

सत्यमेव जयते